VOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

METAL FINISHING

AUGUST, 1949 VOLUME 47 • NUMBER 8

Founded as Metal Industry, January, 1903
by Palmer H. Langdon, 1868-1935

Editorial and Business Staff

L. H. LANGDON, *Publisher*
PALMER H. LANGDON, *Assistant Publisher*
THOMAS A. TRUMBOUR, *Business Manager*
JOAN T. WIARDA, *Sales Manager*
WALTER A. RAYMOND, *Engineering Editor*
FERDINAND C. WEHRMAN, *Western Editor*
FRED A. HERR, *Pacific Coast Editor*
JOHN E. TRUMBOUR, *Equipment & News Editor*

Published Monthly by

FINISHING PUBLICATIONS, INC.

founded 1903 as
Metal Industry Publishing Co., Inc.
11 West 42nd St. New York 18, N. Y.
Telephone: PEnnsylvania 6-0226

Branch Offices
Chicago 11
612 N. Michigan Ave.
WHitehall 4-1920

Los Angeles 13
424 S. Broadway
MAdison 6-5421

also publishers of
Organic Finishing, monthly, $3.00 per year

Member

ECA NBP

National Conference of Business Paper Editors

Copyright 1949 by Finishing Publications, Inc. Entered February 25, 1903, at New York, N. Y.; as second class matter under Act of Congress, March 3, 1879. Re-entered as second class matter June 13, 1940, at the post office at New York, N. Y., under the Act of March 3, 1879.

SUBSCRIPTION PRICES: United States, $4.00 and Canada $4.00 per year. Other countries $8.00. Single copies 45c in U. S. and Canada, Foreign 85c. Guidebook-Directory published as separate volume in pocket size form $1.50. 1948 edition current. Please remit by check or money order; cash should be registered.

Contributed articles, communications, etc., on pertinent subjects are invited. Their publication, however, does not necessarily imply editorial endorsement.

CONTENTS

Editorial 39
Milwaukee Convention of the A.E.S. 40
International Fellowship Club 42
Tin-Zinc Alloy Plating 44
By P. J. Miller and J. W. Cuthbertson
A Critical Survey of Plating Practice for Zinc-Base Die Castings 50
By Joseph Haas
High Pressure Sandblasting 56
By Joseph Albin
Adsorption Phenomena in the Plating Room 58
By H. A. Fudeman
Future Outlook for Metals Used in the Plating Industry 62
Shop Problems 64
Engineering Data Sheet 66
Patents 67
Recent Developments 70
Business Items 82
Obituary 88
Associations and Societies 89
Technical Literature 93
Letters to the Editor 93
Manufacturers' Literature 95

COMING SOON

An article describing methods for depositing pre-plate immersion films on aluminum alloys in such metals as zinc, cadmium, and tin.

Methods of analysis of plating baths utilizing the new rapid methods by colorimetric measurements.

A discussion of special purpose, automatic polishing and buffing machines, and how they are adapted to special problems in metal finishing.

Plating of metals by deposition from the gaseous phase, wherein extremely rapid deposition is possible and no baths or solutions are required.

LEA
COMPOUND
MANUFACTURED BY
THE LEA MANUFACTURING CO.
WATERBURY, CONN.
OPEN THIS END
2,502 vs 1,170
*SAME PLANT, SAME OPERATOR, SIMILAR PIECES
(2,502 represents Grade "B" Lea Compound Production per Bar)
(1,170 represents Competitive Compound Production per Bar)

Which would you rather have coming off your production line? The former, of course, *provided* the ratio of "B" Lea Compound cost to that of the competitive material was well within the production ratio. It is . . . proving again that the use of Lea Compound is a much more economical production step.

How, you ask, can Lea Compound be so much better?

Well, here are a few of the Lea "quality" characteristics:

1 . . . a much better and more durable binder is used, resulting in much less "fly off the wheel" waste.

2 . . . very uniform as to grain and binder, resulting in more uniform production speed and finish.

3 . . . the container is much more impervious to moisture loss — our standard all-aluminum container can keep compound in good condition for a year or so if stored properly.

4 . . . all Lea products are produced under strict technical control.

The list of Lea users is constantly growing because more and more are convinced—by tests—that there is more production and better production in a bar of Lea Compound or Learok than in any other material . . . more per dollar invested in compound.

If you are interested in production quality and production economy, you owe it to yourself to be a "Lea" user.

BURRING, BUFFING AND POLISHING . . . MANUFACTURERS AND SPECIALISTS IN THE DEVELOPMENT OF PRODUCTION METHODS, EQUIPMENT AND COMPOSITIONS.

®

THE LEA MANUFACTURING CO., 16 Cherry Avenue, Waterbury 86, Conn.
Lea Mfg. Company of Canada, Ltd., 370 Victoria Street, Toronto 2, Canada

ESTABLISHED 1903

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

METAL FINISHING

VOLUME 47 • NUMBER 8 • AUGUST, 1949

The Return to Efficiency

To say that present business conditions throughout the country are causing many a repentant reflection would be facetious indeed. Most of us are refreshed at the thought of automobile dealers who once met with a complacent yawn our urgent requests for a new car being forced to get their feet off of their desks and ring the doorbells of prospective customers, a condition which cannot help but be best for all concerned in the long run. Someday maybe it will even be possible to get a ride in the exact car we contemplate buying!

The decline from the dizzying heights of the past few years has permitted (or forced) every business man and wage earner to take complete stock of his past actions, present inventories, and future prospects. Those who, despite the multitude of opportunities for excessive demands or slipshod service upheld the cardinal business principle of an equitable exchange of products for payment, or service for wages, can face the future with a much more confident air than their shaky competitor. Suppliers who went out of their way to meet their customer's needs for goods or services are now reaping their harvest in being awarded the less-readily obtained orders; workers who gave their job just a little extra are being retained on the payrolls, while the shirkers are being let go, at least insofar as union agreements make it possible. In the latter respect, every indication points to the fact that management is going to have a lot more to say about how their plants are run than they have had in the past ten years.

In a system of free enterprise such as we enjoy in this country, there is not much that government alone can do to legislate prosperity—it's up to business, large and small, to carry the economy at the high levels we are accustomed to and desire to maintain. And competent business men all agree that the only thing required to keep this economy at a high level is EFFICIENCY all down the line—in manufacturing, selling, and distribution. Any action which opposes this condition is a step in the wrong direction.

Let's hope the American wage-earner, and that includes just about everyone concerned, can get used to this idea again in as painless a manner as possible.

CORRECTION

In last month's editorial a printer's error in the last sentence of the fourth paragraph completely destroyed the meaning of the entire paragraph. This sentence should have read as follows:

Perhaps the same foresight that prompted the initiation of the plating industry's waste disposal research program could also muster the necessary diplomacy to see that sufficient of the funds that undoubtedly will be available to carry out the program of P. L. 845 be reserved for financing the continuation of the plating industry's already going program.

UNIVERSITY OF MICHIGAN LIBRARIES
UNIVERSITY OF MICHIGAN LIBRARIES

Technical Sessions Highlight Milwaukee Convention Of A.E.S.

THE 36th Annual Convention of the American Electroplaters Society held on June 27-30 in Milwaukee, turned out to be one of the most successful in the history of the Society.

In spite of the substantially lessened activity in most branches of the electroplating and metal finishing industry, which it was felt might reduce the attendance at this annual affair, representatives from nearly every state of the Union converged on Milwaukee for an intensive four-day check-up and refresher course on the latest developments in the field, and to renew old friendships and attend the Annual Meeting of the Society. Approximately 1,000 persons registered for the various business, social and technical sessions, which started with the welcoming address by the Convention Chairman *Mr. William Geissman* and continued for four days to the closing social event of the Annual Banquet.

This year's registration accurately reflects the growth of the Society, for at the previous convention held in this same city eleven years ago under similar business conditions the total registration was only about half of this year's total.

William J. Neill
Supreme First Vice-President

Arthur Logozzo
Supreme President

Citizens of Milwaukee will waste no time in telling you that their city is the finest convention town in the world, and the excellent results of the efforts of this year's convention committee makes one wonder if Milwuakeeans are not taught the techniques of successful convention management at an early age in their school systems. If so, certainly Bill Geissman's hard-working and genial committee must be honor graduates.

While it would be a Herculean task to record all the happenings at the convention, the following highlights of the various "goings-on" will keep informed any unfortunate metal finishers who were unable to be in Milwaukee to swap experiences, information, and risqué jokes with their fellow men.

Technical Sessions

Complete publication of all technical papers presented at the Convention, together with the discussions following the presentation of each, will be found in a forthcoming volume "36th Annual Proceedings of The American Electroplaters Society" to be published by the Society at an early date. A list of the papers and authors, together with a brief abstract of each paper, was published in the June issue of *Metal Finishing*, and therefore will not be repeated here.

Annual Meeting

Supreme President *Sam Johnson* presided at the annual meeting of the Society held on Thursday afternoon, and called on the various committee chairmen for their reports.

Second Vice-Pres. *Bill Neill* reported for the Membership Committee, and announced the following winners of the contest for increasing the membership of the branches:

Class 1—Grand Rapids Branch
Class 2—Sydney (Australia) Branch
Class 3—Saginaw Valley Branch

Each branch received as a winner's prize $50 in cash in lieu of the trophy given in former years.

C. F. Nixon
Supreme Second Vice-President

First Vice-Pres. *Art Logozzo* presented the report of the Budget Committee for 1949-50, which was approved as recommended after a short discussion by the delegates.

Several proposed amendments to the By-Laws of the Society, dealing with membership dues and members per-capita tax transfers were taken under advisement by the Executive Board.

Election of Officers

The following officers were elected to head the Supreme Society for 1949-50:

President—*Arthur Logozzo*, Pres. Nutmeg Chrome Corp., Hartford, Conn.
1st Vice-Pres.—*William Neill*, Columbus Metal Products, Inc., Columbus, O.
2nd Vice-Pres.—*Cleve Nixon*, Ternstedt Div. General Motors Corp., Detroit, Mich.
3rd Vice-Pres.—*Franklyn MacStoker*, Farrand Optical Co., New York, N. Y.
Exec. Secretary—*Dr. Kenneth Graham*, Jenkintown, Pa.

The only balloting required was for the position of 3rd Vice-President, where a contest between Mr. William Geissman, of the Milwaukee Branch, and Mr. MacStoker, of the New York Branch developed. Mr. MacStoker led the balloting by a 67-47 count, whereupon the Geissman delegates made it a unanimous vote by withdrawing their candidate. After the election, the incoming officers were sworn in by *Mr. John Feeley*, a member of the Montreal Branch and one of the oldest members of the Society.

F. J. MacStoker
Supreme Third Vice-President

Honorary Members

Four men were elected to Honorary Membership in the Society. They were:

Mr. Thomas Slattery—Washington Branch
Mr. Joseph Sexton—New Haven Branch
Mr. John Lockerby—St. Joseph Valley Branch
Mr. Edward Musick—St. Louis Branch

S. S. Johnston
Past Supreme President

Award of Merit

A new award, called the A.E.S. Award of Merit, was instigated this year by the Executive Board. This Award of Merit will be given to persons who have rendered outstanding service to the Society. The Executive Committee will appoint the recipients of this award. Approved for Awards of Merit this year were:

Dr. E. T. Candee—Lea Mfg. Co.
Mr. Carl Heussner—Chrysler Corp.
Dr. R. M. Wick—Bethlehem Steel Co.
Dr. Louis Weisberg—Consultant
Mr. C. H. Sample—International Nickel Co.

Branch Exhibits

Awards for the best Branch Exhibits of plated ware were made at the Annual Banquet. Winners were as follows:

1st Prize—Columbus Branch
2nd Prize—Twin City Branch
3rd Prize—Chicago Branch

While it did not win an award, the display of chrome plated valves and fittings by the *Perlick Co.*, of Milwaukee, also impressed many who viewed the exhibits.

Paper Awards

Also awarded at the Annual Banquet were the awards for outstanding technical papers of the year. Recipients of these awards were as follows:

Founders Gold Medal—*Dr. W. A. Wesley*, *W. W. Sellers*, and *E. J. Roehl*
A.E.S. Gold Medal—*Mr. Cleve Nixon*
Award for Best Paper Published in the Society Publication—*Mr. Lyman Sperry* and *Mr. Maurice Caldwell.*
Lea Mechanical Finishing Award—*Mr. Arthur P. Schulze*
Chrome Plating Award (Sponsored by the Nutmeg Chrome Corp.)—*Mr. Robert Seegmiller* and *Mr. Vernon Lamb.*

Future Conventions

The next convention in 1950 will be held in Boston, Mass. and will be held in conjunction with the Fourth International Conference on Electro-deposition. These international meetings bring together the outstanding electrochemists and practical plating men in the world, and judging by the quality of the last International Conference held in London, this coming affair should prove extremely valuable. It is expected that the leading experts from many foreign countries will be on hand to exchange information on the progress of electroplating and metal finishing throughout the world.

In 1951 the convention will be held in Los Angeles, and in 1952 in Chicago. Present plans do not call for any exhibits of equipment and supplies at either the Boston or Los Angeles conventions.

Dr. A. Kenneth Graham
Executive Secretary and Business Manager

Fellowship Club Annual Luncheon Draws a Record Attendance.

UNIVERSITY OF MICHIGAN LIBRARIES
UNIVERSITY OF MICHIGAN LIBRARIES

International Fellowship Club 25th Anniversary Meeting

IN celebrating the twenty-fifth anniversary of its founding, the International Fellowship Club again helped to make the Annual Convention of the American Electroplaters Society a memorable social success.

In many ways the activities of the Fellowship Club at Milwaukee this year could be said to have exceeded those of any previous convention, as both the Annual Luncheon and the Golf Tournament drew a record number of participants, while the Open House Party was, as usual, an outstanding success. While the Ladies "Plato" Party was not allowed to proceed because of a local law regarding such affairs, the alternate program whipped together by the ladies in charge, *Mrs. Joan Trumbour Wiarda* and *Mrs. R. F. McGuire*, was equally as entertaining to the ladies. Many beautiful awards, furnished thru the generosity of the suppliers and distributors in the industry, were distributed to the fair sex at this event.

Those who traveled to the convention on *T. A.* (Travel Agent) *Trumbour's* "Broadway Limited" were treated to a preliminary show in the form of a long distance walking contest by *John Oberender* as well as hearing a somewhat off-key rendition of "Happy Birthday to You" tendered to *Mr. George Hogaboom*, who was celebrating his 75th birthday by taking Mrs. Hogaboom along to enjoy the convention.

Annual Luncheon

The Annual Luncheon this year attracted 141 members, by far the larg-

Rudy Hazucha
President

George L. Nankervis
First Vice-President

A. P. Munning
Second Vice-President

Al Braun
Third Vice President

T. A. Trumbour
Permanent Secretary

Louis M. Hague
Retiring President

est turn-out ever recorded for this event. Many of those who attended came especially for the Silver Anniversary of the Club. Presiding at the luncheon was Chairman *Louis M. Hague*, of the Hanson-Van Winkle-Munning Co., who introduced each member. A short history of the Fellowship Club and its activities was given by *Mr. Wilfred S. McKeon*, of Sulphur Products Co., one of the founders.

The only business allowed at these once-a-year meetings of the Club is the report of the Secretary, *Mr. Tom Trumbour*, and the election of the officers for the next year. The new Chairman is *Mr. Rudy Hazucha*, of the Clinton Co., while *Mr. George Nankerris* and *Mr. A. P. Munning* moved up to First and Second Vice-Chairmen, respectively. The new member of the executive group is *Mr. Al Braun*, of the Agate Lacquer Co., while *Tom Trumbour* was again returned to the office of Permanent Secretary, a position he has held now for twenty years.

Open House

This year's Open House Party, sponsored by the Fellowship Club and held on the first evening of the Convention, was voted by all who attended as probably the best ever held. In addition to a fine buffet supper, a show, and dancing, registrants were the lucky recipients of several beautiful awards, as well as a number of U. S. Savings Bonds. The fortunate winners and their awards were:

R. Wallace Silver Tea Set (6 pieces)—Bert Kirchoff, Jamestown, N. Y.

Oneida 52 piece Silver Plate Service—Ivan Hepfer, Grand Rapids, Mich.

Twenty-Five Dollar U. S. Savings Bonds — Henry Mahlstedt, Old Greenwich, Conn.; John Mitchell, Minneapolis, Minn.; John Anderson, Owatonna, Minn.; Mrs. J. W. Ninnemann, Milwaukee, Wisc.; Carl Heussner, Birmingham, Mich.; William Scott, Avon Lake, Ohio.

Golf Tournament

Seventy-six hopefuls entered the golf tournament held at the North Shore Country Club on Wednesday afternoon. Whether or not the fact that the clubhouse flag was flying at half-mast all afternoon was the cause or the effect of the struggles taking place all over (and we do mean all over) the course has not been determined, but it certainly proved an accurate barometer for the days activities. When the last divot had been replaced and the shades of evening returned the former peacefulness to the surroundings, the weary participants all showed the "stuff" they are made of by being able to finish the 19th hole in par figures. Highlights of the day's play were as follows:

Winner—*Jim Badaluco*, of J. C. Miller Co., Grand Rapids. 82-11-71

(*Continued on Page 88*)

Speakers table at Fellowship Club's 25th Annual Luncheon. Wilfred S. McKeon and John Oberender, first officers of 25 years ago, are seated to the left and right respectively of this year's president Lou Hague.

UNIVERSITY OF MICHIGAN LIBRARIES

Tin-Zinc Alloy Plating

By P. J. Miller *and J. W. Cuthbertson **

ELECTRODEPOSITED coatings are widely used for the protection of steel and other metals against corrosion. Tin, zinc, and cadmium deposits are commonly employed for this purpose, and each of these deposits has its advantages and its limitations. Tin is inherently resistant to atmospheric corrosion, but the thin tin deposits such as are normally applied to steel are porous, and rusting occurs at the pore sites. Zinc is anodic to steel and protects the basis metal by sacrificial action, being itself attacked in the process. This attack leads to the formation of white zinc corrosion products which soon spoil the surface appearance of the work. Moreover, protection of the steel is only ensured so long as a certain amount of the zinc remains unconsumed, while a further disadvantage of zinc coatings is the difficulty of soldering them with non-corrosive fluxes. Cadmium affords good protection in some, notably marine, atmospheres but its behavior in heavy industrial atmospheres can be very disappointing. Also, cadmium today is a very expensive metal and this consideration alone is militating against its use.

From the protective viewpoint the most attractive type of coating would appear to be one which was inherently very resistant to atmospheric attack and which was mildly anodic to steel. Tin is cathodic to steel, but by alloying with zinc a deposit can be obtained which is sufficiently anodic to steel to prevent rusting in the event of the coating being accidentally damaged and the steel exposed. Owing to the presence of the tin, the rate of corrosion of a tin-zinc coating is much slower than that of a pure zinc coating, and with coatings containing more than about 70 per cent of tin there is no noticeable contamination by zinc corrosion products even after a long period of service. For a given set of plating conditions, alloying leads to a reduction in the crystal grain size of an electrodeposit. This refining action is very pronounced in the case of the tin-zinc plate, and is coupled with a substantial reduction in porosity as compared with tin of similar thickness. Taking all factors into consideration, a tin-zinc alloy plate of suitable composition therefore offers the combined advantages of tin and zinc coatings as a means of protecting steel against corrosion, while simultaneously reducing the disadvantages of the constituent metals when employed alone. These observations apply primarily to coated but unpainted steel. If it is intended to paint, tin-zinc plate is again attractive, as it forms a much better basis for paint than cadmium plate.

An earlier investigation of the corrosion-resisting properties of tin-zinc alloy electrodeposits[1] established that coatings containing 50 to 80 per cent of tin afforded good protection to steel, the protective value increasing with the tin content. With more than 80 per cent of tin the protection diminishes, possibly because the deposits are more porous. With less than 80 per cent of tin, down to a limit of 50 per cent, there is a progressive but relatively small fall in protective value. With still less tin the deposits resemble zinc in character and offer no advantages over that metal. For all ordinary purposes the preferred composition range is:

Tin	75-80%
Zinc	20-25%

This is the most protective range, and although the amount of tin can be somewhat reduced without much loss in protective value, the appearance of the plate deteriorates and its solderability diminishes if this is

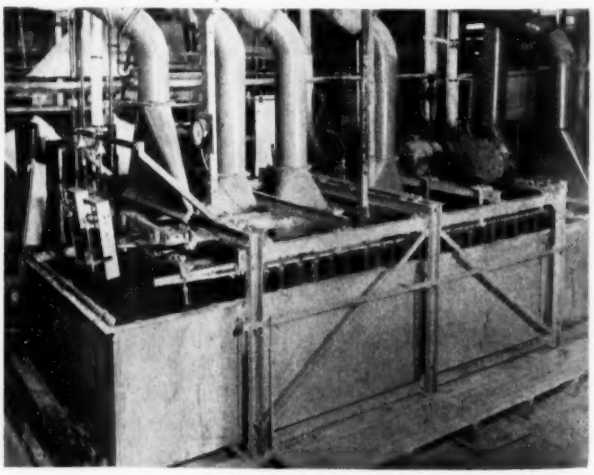


Fig. 1. General view of 1500 gallon semi-automatic tin-zinc alloy plating tank, showing conveyor chain, exhaust ducting, and one row by anode suspension clips.

* *Electroplating Chemist, E.M.I. Factories Ltd., Hayes, Middlesex, England.*
** *Assistant Director of Research, Tin Research Institute, Greenford, Middlesex, England.*

Fig. 2. View of the 1500 gallon tank, showing cathode conveyor and anodes.

done. Further, deposition presents technical difficulties when the zinc content of the plate exceeds about 30 per cent. Extensive corrosion tests, backed up by considerable practical experience, have established that tin-zinc plate of the above recommended composition, not less than 0.0003" in thickness, affords excellent protection to steel, and this composition is, in fact, the only one which has been developed on an industrial scale.

Tin-zinc alloy plating has been practiced commercially in England for more than two years and interest in the process is increasing. The main outlet for this new coating has so far been the electrical industry, where it is being used for the protection of loud speaker frames, radio chases, switchgear parts, and miscellaneous small components. Other uses are under consideration, and the coating is suitable for all purposes where hitherto cadmium has been used.

The theory of tin-zinc plating has already been discussed in detail in two earlier publications.[2, 3] This article is concerned with practical experience obtained in the operation of the process, and for theoretical details readers are referred to the aforementioned papers. For the present purpose it will be sufficient to state that the tin-zinc electrolyte contains sodium stannate, sodium hydroxide, zinc cyanide, and sodium cyanide, and is operated with filmed alloy anodes of the same composition as the alloy being deposited. Full details covering the operation of the process are given in the working instructions issued by the *Tin Research Institute*.[4]

Plating Equipment

The tin-zinc plants now operating in England are mostly cadmium plants which have been converted for the purpose. Prior to 1948 the plant described in this article was operating on cadmium, and in changing over to tin-zinc the only basic modifications were the substitution of a new electrolyte and new anodes and the provision of adequate internal heating. No alteration was made in the cycle of cleaning operations prior to plating, and apart from changing one tank to a different passivating solution, the same sequence and method of rinsing after plating was retained. The plating plant comprises two semi-automatic baths and one still bath, and the notes which follow apply mainly to the semi-automatic baths on which the bulk of experience has been gained.

The baths are of the return conveyor type, being loaded and discharged at the same end. Their respective capacities are 900 and 1500 U. S. gallons; the larger bath is shown in Fig. 1. The cathode hangers, from which the work is suspended on suitable racks, are pushed along the negative conductor rail by insulated toggles attached to the conveyor chain (Fig. 2). The tanks themselves are of 5/16 in. welded steel plate and are insulated internally on the sides only by ¼ in. reinforced plate glass. The positive conductor bars which carry the anodes are raised well above the level of the solution and above the openings in the exhaust ducting. As will be seen, ample provision has been made for the removal of steam and spray, and apart from the resulting benefit to the workers this provision has been of great assistance in preventing the development of faulty anode contacts through corrosion by electrolyte spray.

The anodes are of cast 80/20 tin-zinc alloy and are preferably of oval cross-section. They are suspended by steel rods screwed into the upper ends and riveted to brass hooks. A positive electrical contact with the anode bars is essential and the type of clip patented by *Messrs. W. Canning & Co. Ltd.*, which ensures good contact while permitting the anodes to be readily detached when they have to be withdrawn from the bath, has proved very satisfactory in practice. The use of the intermediate steel piece in the anode support assembly ensures that in the event of the electrolyte coming over the top of the anodes no objectionable impurity will pass into the solution through anodic attack of the support. If brass hooks are screwed directly into the anodes there is always the danger of copper entering the bath; nickel or nickel-plated hooks should never be used as even a trace of nickel in the solution greatly lowers the cathode efficiency.

The plating tanks are heated by steam coils of mild steel tube. Each tank is provided with two serpentine coils, one at each end. The coils are close to the sides of the tanks and can be replaced, if necessary, without interfering with the working of the baths. Side coils are preferable to coils lying on the bottom of the tank, not only from the easy removal viewpoint but because the sludge in the tank is not then disturbed when the steam is turned on or shut off. Thermostats maintain the temperature at 63-67° C. (145-153° F.). Dial thermometers are provided so that the operatives can check that the thermostats are functioning correctly.

In this plant the two conveyor tanks are fed in parallel from a single d.c. generator rated at 8 volts 2000 amps. The current fed to each tank is adjusted by series resistances. This is not a very satisfactory arrangement, and it would be better to provide a separate generator or rectifier for each tank. Such an arrangement would give greater economy in the consumption of electrical power and greater flexibility of control. The parallel wiring of the two tanks is a particular disadvantage in starting up when the voltage on one of the tanks has to be increased in order to film the anodes. During the filming operation the resist-

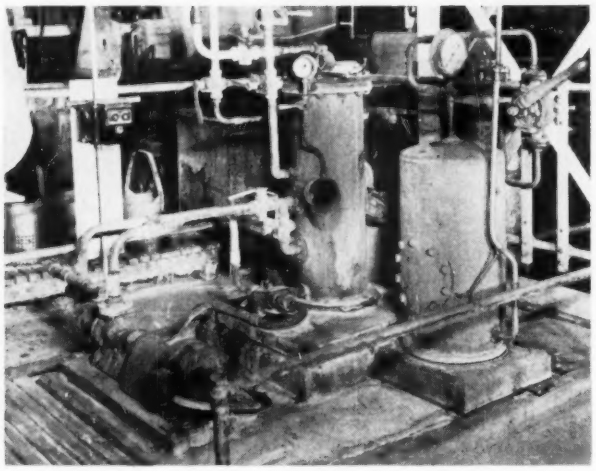


Fig. 3. Pump and filters serving the two semi-automatic tanks.

ance feeding the tank in question is short-circuited and the full voltage of the generator is thus made available. The short circuiting inevitably leads to some fall in voltage on the other tank but this can be rectified by readjusting its feed resistance.

Tin-zinc plating solutions in heavy use should be filtered frequently and, if possible, continuously. A single filter unit serves the two semi-automatic tanks and the procedure is to filter each tank continuously on alternate days. A storage tank is provided, and when the plating tanks require cleaning the electrolyte can be pumped into the storage tank and filtered at the same time. The electrolyte is then allowed to flow back to the plating tanks by gravity. In this plant carbon is used as the filtering medium. Alternatively, calcined alumnia gives satisfactory results. Siliceous filtering aids must not be used as they are attacked by the sodium hydroxide in the electrolyte. The filtering equipment is shown in Fig. 3.

Preparation of Work for Plating

The bulk of the work plated in this plant is of pressed steel. Tin-zinc can, however, be deposited quite readily on copper, brass, and similar alloys. The solution has detergent properties, but good cleaning before plating is nevertheless necessary. In particular, every trace of rust and scale must be removed. Tin-zinc plate blisters badly on rusty steel and also on solder and lead alloys. If much solder is present on the work flash copper plating before applying the tin-zinc becomes essential.

The cleaning procedure adopted is as follows:

1. Vapor degrease in trichlorethylene.
2. Pickle in inhibited 10 per cent sulphuric acid at 65°C. This is primarily to remove spot welding marks and light scale or rust. The maximum pickling time is 5 minutes.
3. Rinse in cold water.
4. Clean electrolytically in boiling 5 per cent sodium hydroxide solution. Current at 12 volts is supplied to the cleaning tank. The cleaning is alternately anodic and cathodic, the polarity being reversed by moving the racks carrying the work along the tank, during which they alternately make contact with positive and negative conductor bars. The whole operation takes only two or three minutes. In their last position, before removal, the racks are, of course, made anodic to ensure that any metallic film deposited on the work during the preceding cathodic cycle is removed.
5. Rinse in cold water.
6. Rinse in a cold 5 per cent solution of sodium cyanide.
7. Transfer direct to the plating tank.

This cleaning cycle has been carefully worked out on the basis of experience gained in the plating of a wide variety of steel pressings. It has given very satisfactory results in service, and rejects due to faulty cleaning are of extremely rare occurrence.

Plating Procedure

The articles plated vary widely in shape and size, from small parts such as brackets and spindles to radio chassis measuring about 18″x12″x4″. All work is suspended on hangers, and six different types of hanger are kept in readiness to handle the variety of parts. The smaller parts are suspended in bulk, using hangers provided with fifty or more hooks. The largest parts are suspended singly. In arranging the articles on the hangers care is taken to avoid the shadowing of one part by another, and recessed components are hung so that the recesses are favorably disposed with respect to the anodes. The hangers are made of steel and are riveted to brass contact hooks. Being conducting, the tin-zinc alloy builds up on them and they must therefore be stripped periodically. Stripping is easily effected by anodic treatment in hot, 5 per cent sodium hydroxide. As the hangers have to pass through the trichlorethylene degreaser they cannot be protected by stopping off in the usual way.

Owing to the variety of the work handled it is not generally possible to maintain an absolutely constant, known cathode area in the plating tank. By segregating the large and small parts, however, and by the judicial mixing of the hangers carrying them, the load can be kept sufficiently constant for practical purposes. In this way, keeping the time of plating and bath voltage constant, a considerable measure of uniformity in coating thickness on all components is secured.

The loaded hangers are fed into the tank at the end and after traversing the length of the tank twice are removed at the same end. The total time in the tank is 18 minutes, and at a cathode current density of 15-20 amp. per sq. ft. this is sufficient to deposit an average thickness of 0.0003″ of tin-zinc. When starting up after a shut-down, the tank is fully loaded with work and the current is switched on for 20 minutes with the conveyor stationary. Thereafter the conveyor is started, and the work is fed in and removed in the normal way. Mixed loads are usually plated at 4 volts; on occasions when articles of a single type are being plated, the preferred voltage is 4½ for the large parts and 3½ for small parts. The bath voltage is never allowed to fall below 3½, as at lower voltages the anodes tend to lose their film. Typical examples of some of the medium sized and smaller articles plated in this plant are shown in the accompanying illustration (Fig. 4).

Control of the anode process is extremely important

in tin-zinc plating, and the success of the whole plating operation largely depends on the care bestowed on this factor. The need for a positive anode contact has already been stressed. Every care should be taken to ensure that the anode hooks and anode bars are at all times maintained in a perfectly clean condition. The anode current density must be kept between 7½ and 15 amp. per sq. ft. At lower current densities the anode film is lost and at higher current densities passivity troubles develop. As the anodes dissolve they naturally become smaller and additional anodes must be put into the bath to restore the anode area to the original figure. Old anodes can easily be recast, and it is cheaper in the long run to replace worn anodes than to work them until they have become very thin. The total area is approximately twice the total cathode area, and in practice the work capacity of the tank is determined by the number of anodes which can be fitted into the space available.

On removal from the bath the work is rinsed twice in cold water and is then passivated by immersing for 10-15 seconds in a 2 per cent solution of chromic acid maintained at 50°C. Thereafter, it is again rinsed twice in cold running water, then in hot water, and is finally dried by an air blast. The rinsing, passivating, and drying is done with the work still loaded on the hangers. After drying, the work is unloaded and passes to the inspection bench. Fig. 5 shows the schematic arrangement of the two semi-automatic plating baths and auxiliary equipment.

Technical Control

The compositions of the pickling solution, electrolytic cleaner, and tin-zinc electrolyte are controlled by chemical analysis and additions are made as and when required. The pickling solution is checked daily by titrating a 2 ml. sample with 0.5N sodium hydroxide, using methyl orange as indicator. The electrolytic cleaner is also checked daily, a 2 ml. sample being titrated with 0.1N hydrochloric acid, using phenolphthalein as indicator. The passivating solution is checked by taking hydrometer readings daily, and by occasional chemical estimation of its CrO_3 content. Contamination of this solution, e.g. by sulphate from make-up tap water, leads to staining of the work, and this is best obviated by discarding a part of the bath once or twice a week and making up with new solution.

Each of the tin-zinc baths is tested daily for total cyanide and free sodium hydroxide content. The tin and zinc metal contents are determined twice a week. This procedure ensures that the composition of the deposited alloy is always within the specified limits. As this composition varies linearly with the sodium hydroxide content of the electrolyte, close control of this constituent of the bath is important.

Experience indicates that, provided the composition of the electrolyte, working temperature, and current density are correctly controlled, the composition of the deposited alloy remains substantially constant. Nevertheless, the composition of the plate is checked once or twice a week by plating steel test panels, measuring 3 x 2 in., along with the work and subsequently stripping the deposits from them and analyzing. The analytical procedure adopted for checking the composition of the plate and electrolyte is that recommended in the aforementioned working instructions.[4]

Production Experience

As in all new processes, some teething troubles developed in the early days, but all of these were soon overcome and during the fifteen months that the process has been in operation there have been no serious delays or breakdowns. A pilot plant, comprising a 900 gallon still bath, was operated for two months prior to starting up the semi-automatic tanks, and the experience gained with that plant was largely responsible for the smooth working which was so soon achieved with the two larger units. The main difficulty with the pilot plant lay in persuading the operators to load the bath correctly. Overloading was common, and as a result trouble was frequently experienced through the anodes becoming passive. Splashing of electrolyte over the anode hooks through carelessness in removing work from the bath was another cause of anode trouble. Fortunately, both of these troubles disappeared when the change-over to the larger units was made. With these units there is little chance of the drag-out splashing the anodes and the facts that the plating process is continuous and that the anode area is practically constant greatly simplify the correct proportioning of the cathode load.

The metals deposited at the cathode are replaced almost quantitatively by the dissolution of the anodes, but inevitable losses of tin and zinc occur through drag-out. It is therefore necessary to make periodical additions to sodium stannate and zinc cyanide to compensate for these losses. Under plating conditions sodium hydroxide is slowly converted into sodium carbonate, and hydroxide must therefore be added as required. From the replenishment viewpoint the sodium cyanide calls for the most frequent attention. At the temperature of the tin-zinc bath (65°C.) sodium cyanide undergoes fairly rapid hydrolytic decomposition, and frequent additions are necessary to maintain the cyanide content at the correct figure. The normal variations in cyanide content occurring between periods of adjustment are without effect on the composition of the plate, but if the free cyanide is allowed to

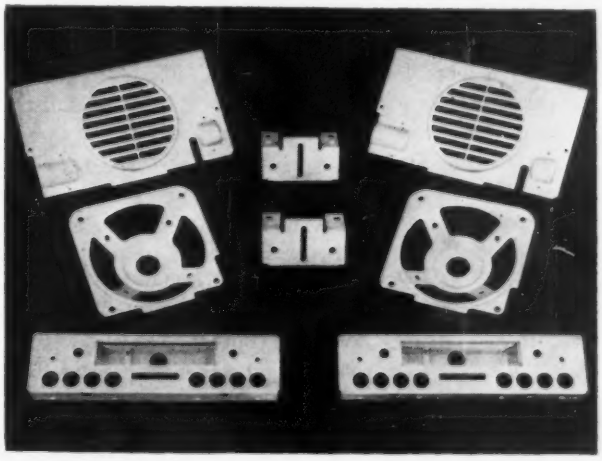


Fig. 4. Steel pressings plated with 80/20 tin-zinc alloy. These are typical of the work handled in this plant.

fall below 17.5 g. per litre (2.3 oz./gal.) the amount of zinc in the deposit increases rapidly. The main product of the decomposition of the cyanide is sodium carbonate, and this accumulates in the bath until the saturation point is reached. As the amount of carbonate increases there is a slight, progressive fall in cathode efficiency, but the loss in efficiency does not exceed 10 per cent at saturation. However, highly carbonated solutions are troublesome to maintain, as the carbonate hinders the chemical dissolution of any additions that require to be made to the electrolyte, particularly the dissolution of sodium cyanide. Excess carbonate should therefore be removed before the saturation point (at the working temperature) is reached. Removal of excess carbonate is most easily effected by cooling the solution and allowing it to crystallize out. The clear liquor is then pumped into the storage tanks and the crystals are removed from the bath. Any tendency of the electrolyte to crystallize out in the circulating pipes during this operation is overcome by pumping hot water through the pipes.

The tin-zinc electrolyte has a slight solvent action on iron; dissolved iron is present in the solution as a ferrocyanide anion. This action is slow, and after some months in use a balance appears to be established between the rate of dissolution of iron and the rate of its removal by drag-out. Experience indicates that this equilibrium concentration is in the vicinity of 2 g. of iron per litre. This amount of iron has no measurable effect either on the cathode deposit or on the dissolution of the anodes. The iron enters the solution partly from the tank and partly from the steam heating coils with which the electrolyte is in contact. No discernable damage has occurred to the tanks since they have been in service, however, and no leaks have developed. On one occasion a steam coil failed, but it is believed that in this case attack was accelerated by the use of an inferior grade of steel for the coil. Clean, low-carbon steel is attacked less readily than poorer grades. Trouble with welds largely disappears if they are properly made and annealed to lessen the risk of caustic embrittlement.

Components to be tin-zinc plated ideally should be free from spot-welded, lapped joints where electrolyte or passivating solution may become entrapped. In practice, it is more often than not impossible to obtain this ideal. Special care must therefore be taken in the rinsing of work having such joints. The complete removal of solution from the joints is difficult, and if the rinsing operations are not efficiently carried out seepage may occur after the work has been stored for some time. The tin-zinc electrolyte has a solvent action on the deposit, and thorough rinsing after plating is therefore essential. One or two instances of rusting at such joints were at first attributed to insufficient thickness of plate on the areas concerned, but it is now known that these failures were due to the coating being partly dissolved by residual entrapped electrolyte. It may be mentioned that the throwing power of the tin-zinc bath is excellent, both as regards the thickness of the deposit and its uniformity of composition, and corrosion tests on recessed articles, free from joints

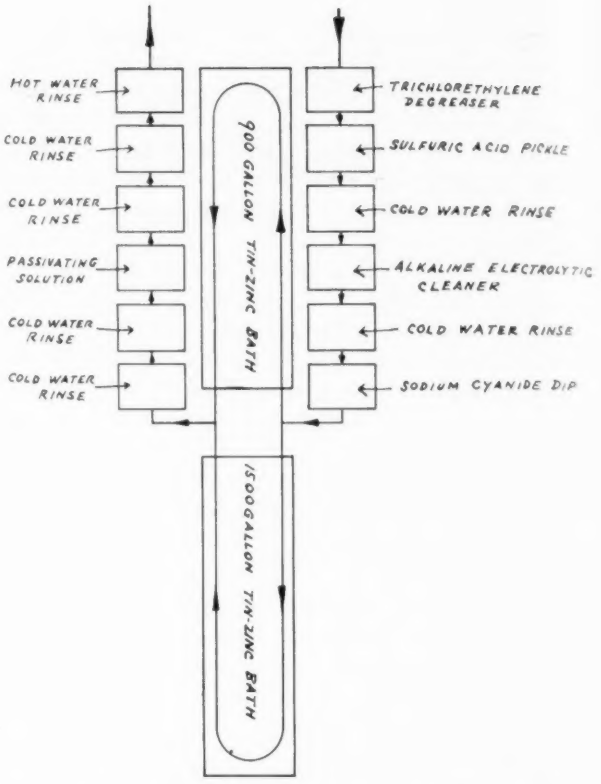


Fig. 5. Schematic layout of plating baths and auxiliary equipment.

of the aforementioned type, have revealed no fall in corrosion resistance in corners and angles. Entrapped passivating solution does not, of course, lead to any corrosion troubles but causes unsightly staining when it seeps out. Air agitation of the cold water rinses is a great help in ensuring that all traces of electrolyte and passivating solution are removed. A minor complication which agitation involves is the tendency for the air bubbles to dislodge small, light components from the hooks on the hangers, causing them to fall into the rinse tank, but this could doubtless be overcome by modifying the design of the hooks, e.g. by using a spring-loaded contact.

The complete removal of electrolyte from the surface of plated work becomes more difficult as the concentration of sodium carbonate in the electrolyte increases. In an attempt to improve the rinsing under these circumstances some trials were made using one of the proprietary de-watering fluids now on the market. The results obtained were most encouraging. After the final cold water rinse the articles while still on the hangers were immersed for a few seconds in a tank of de-watering fluid. They were then withdrawn and allowed to dry by unaided evaporation. Some articles thus treated were submitted to the humidity corrosion test and no seepage, corrosion at joints, or staining occurred. The de-watering fluid used left a thin film of protective grease or oil on the surface of the work, but this did not in any way interfere with solderability.

Comparison of Costs

Economic considerations weighed largely in the decision to change over this plant from cadmium to tin-

zinc. After operating the tin-zinc process for over a year it is possible to give some figures for the relative costs of the two processes.

The electrical power consumed in cadmium plating and in tin-zinc plating is approximately the same, but there is an additonal item in tin-zinc plating in the heat that must be supplied to maintain the bath at the working temperature. The labor charges for the two processes are similar, with the exception of the extra labor costs involved in the periodical removal of excess carbonate from the tin-zinc solutions.

The monthly expenditure on anodes and plating chemical additions over corresponding periods of nine months in 1947 and in 1948 is shown in the first two columns of the accompanying Table I. To place the comparison between the total materials costs for tin-zinc and cadmium plating on an even basis it is necessary to multiply the costs for cadmium plating by the factor 1.2 in order to equalize the gallon-months for the two processes. The corrected figure in the third column of the table represents this adjustment.

TABLE I

Monthly expenditure on anodes and chemicals, in dollars.

	Tin-Zinc	Cadmium	Cadmium (corrected)
Anodes	1518.20	3484.00	
Chemicals	1023.40	196.80	
Total	2541.60	3680.80	4416.96

The cost for steam heating the tin-zinc baths is estimated at $80.00 per month. The charges for the removal of excess carbonate twice in the nine months under consideration amounted to $108.00, or $9.00 per month. Taking these additional items into account the monthly expenditure for the two processes becomes: tin-zinc $2633.60; cadmium $4416.96. The ratio of the costs for the two processes, excluding the normal labor costs common to both, is thus:

$$\frac{\text{Tin-Zinc}}{\text{Cadmium}} = \frac{1}{1.68}$$

For a cadmium coating 0.0003" thick, purchasing anodes at $2.80 per pound *(Editor's Note—These are British prices. Current prices for cadmium anodes in the U.S.A. are around $2.10)* the total materials cost, excluding labor costs, for plating on steel works out to 3.97 cents per sq. ft. For a tin-zinc coating of the same thickness, with anodes purchased at $1.02 per pound, the corresponding cost is 2.36 cents per sq. ft. The saving in favor of tin-zinc thus amounts to 1.16 cents per sq. ft.

Acknowledgments

The authors are indebted to Messrs. E.M.I. Factories, Limited, and to the Tin Research Institute for permission to publish this article. Permission granted by Messrs. E.M.I. Factories, Limited, to reproduce photographs of their tin-zinc alloy plating plant and of samples of work plated therein is gratefully acknowledged.

References

1. *R. M. Angles and R. Kerr.* Engineering, 1946 *161*, 289.
2. *R. M. Angles.* J. Electrodepositors' Tech. Soc., 1946, *21*, 45.
3. *J. W. Cuthbertson and R. M. Angles.* Trans. Electrochemical Soc., 1948, *94*.
4. "Working Instructions for Tin-Zinc Alloy Plating." Published by the Tin Research Institute, Greenford, Middlesex, England. Obtainable from the *Tin Research Institute, Inc., 492 West 6th Avenue, Columbus, Ohio.*

A Critical Survey of Plating Practice for Zinc-Base Die-Castings

By Joseph Haas, *Industrial Engineer*

MANY articles have been written on the plating of zinc and zinc-base die-castings by practical electro-platers, and much technical information has been published by the various societies. Over a period of years, the largest distributor of zinc, in order to encourage the wider use and consumption of zinc for metallic articles, has published five booklets dealing with the finishing of die-cast zinc. Yet in any gathering of platers the procedure or methods best suited for the plating of zinc or zinc-base die-castings continually arises. Apparently, the plating of this metal is still an every day problem to a great many in the industry. In addition to the question of preparing die-castings for plating, the question is invariably raised as to what metal to plate with, and what metal should be the initial coating.

This survey may not provide a satisfactory answer to the latter question, but at least available data and information will be gathered, controversial opinions correlated, and detail of the writer's opinion and experiences will be given. With the understanding that successful plating on die-castings, meaning a good deposit that does not blister, one that will withstand atmospheric exposure without corrosion or failure for a reasonable time, and can be further electroplated with other metals or chemically treated to produce various finishes, depends upon receiving castings that are smooth, non-porous, and free from any other surface defects, this survey deals with electro-plating only.

Before proceeding with the historical data, it would be advisable to enumerate the problems or difficulties involved in the plating of zinc or zinc-base die-castings. In the writer's opinion, there are three:

1. The discoloration and black streaking of zinc or zinc-base die-castings when plated in a regular nickel solution.
2. The blistering of a copper or brass deposit, when zinc or zinc-base die-castings are plated in the same solutions that otherwise prodcce good deposits upon steel or brass articles.
3. The absorption of copper, brass, gold, etc., except nickel, by zinc or zinc-base die-castings.

Streaking of Die-Castings in Regular Nickel Baths

If we should attempt to plate nickel upon zinc or zinc-base die-castings from a solution that we use to plate upon steel or brass, we would find that our zinc articles have a black, streaky deposit on them. The black deposit is finely divided metallic nickel. Examination of the electromotive series for metals immediately reveals the reason for this. Zinc, being the more electro-positive metal, displaces nickel from a solution of its simple salts, in the same manner that iron or steel displaces copper from a copper sulphate solution. This black deposit of finely deposited nickel is non-adherent.

Even if the electric current should be on, at the normal voltage and current density that we plate steel or brass, this black streaky deposit would occur, because the solution pressure of zinc in the nickel electrolyte is greater than the discharge potential of the nickel ion (Ni^{++}), so that before sufficient voltage can be applied to counteract the solution pressure of zinc, nickel has deposited by simple immersion, and the zinc surface no longer is a satisfactory surface upon which to deposit a subsequent deposit of nickel.

Serious industrial plating upon zinc started about 1894, and beginning with that year articles were written and questions were answered giving details on the plating of this metal. The general practice at the time was to copper or brass plate for 10 minutes, color buff, and then plate in a nickel solution for 3-5 minutes at 4-5 volts. Such a nickel deposit was very light, and all the color buffers could do was to go over it lightly. Many platers claimed to have their own special formulas, claiming successful results, which according to standards of today would be questionable. One such formula was:

Double nickel salts	8 ozs.
Single nickel salts	4 ozs.
Sodium chloride	2 ozs.
Magnesium sulphate	4 ozs.
Boric acid	2 ozs.
Water, to make	1 gal.

At the time the writer entered the industrial plating

field (1912), the practice was to copper plate or brass plate 10-15 minutes, color buff, and then plate in the above nickel solution for 3-5 minutes, or to plate directly upon the zinc die castings from a solution of specially prepared nickel salts, known as *Capital* nickel salts, and *Capstone* nickel salts.

In applying copper plating and brass plating as the initial deposit, blistering of the deposit was a frequent occurrence, as the solutions used were the same as were used to plate upon steel. In the use of the above prepared nickel salts to deposit directly upon zinc, better results were obtained, but after a few months of operation the baths failed, and the recommendation of the supply dealers was to throw them away and make new ones!

Although this problem was increasing in importance, apparently little research was being done, because nothing of value on this subject was published until *Hammond*, in the *Transactions of the Electrochemical Society 1916*, presented the first systematic deductions for his recommendations. Summarizing Hammond's article:

1. Sodium citrate, phosphates, bisulphites, do not reduce the potential of zinc in nickel solutions to any lesser degree than zinc has in a normal solution of nickel salts. However, Hammond found that sodium citrate did slow down the rate of nickel deposition by simple immersion, but he did not offer any explanation for this occurrence.
2. He recommended that solutions for depositing nickel on zinc be of low metal concentration, because the higher concentrations deposited nickel by immersion much more rapidly.
3. He stated that an acid was necessary at the cathode, preferably Boric Acid. His explanation of Boric Acid was that it was just acid enough to prevent the inclusion of basic salts in the cathode deposit.
4. A recommended method of operation was:
   a. Atmospheric temperature, because heating the solution increased the rate of deposition by immersion.
   b. In starting the plating, it is necessary to give a "strike" at 3-4 volts, to prevent the formation of streaks. Then the voltage could be reduced to normal operation.
   c. Hammond's solution:

Nickel Sulphate	32 ozs.
Nickel Chloride	2 ozs.
Sodium Citrate	24 ozs.
Boric Acid	4 ozs.
Water	1 gal.

This bath, according to Hammond, could be operated up to 65 amperes per square foot. The use of sodium citrate for plating on zinc metal was not new, as *Pfanhauser* used it in his formula, in a low cencentration of nickel salts, and also used a low concentration of sodium citrate. Hammond's article properly ranks, however, as the first systematic study on this subject.

Blistering of Plated Die-Castings

The blistering of a copper or brass deposit, when zinc or zinc-base die-castings were plated in the same solutions that otherwise produced good deposits upon steel or brass, was listed as the second problem of plating on this metal. This blistering did not occur at all times, but only at periods, which was both annoying and confusing. At this time (1913-1915), the writer was engaged in the plating of phonograph parts, tone arms and sound boxes made of zinc-base die-castings. Accidently, a solution to this problem was found. Members of a chemical class of the New York Branch of the American Electro-Platers' Society, who had been using Rochelle Salt in a combination cleaner and plater, investigated the function of not only Rochelle Salt, but also Sodium Citrate, in copper and brass solutions. The result of this research was published in *The Brass World*, November, 1917. When the Rochelle Salts were used in the copper and brass solutions, with only enough free cyanide to keep the solution from a green color, no further difficulties were experienced in the blistering of copper or brass deposits in plating upon zinc-base die-castings.

At this stage of the writer's experience with die castings, he preferred plating with the brass solution, first because the brass solution operated was bright, eliminating the buff color operation before nickel plating, and also because brass was desirable when the final finish was gold.

In view of the importance that is placed on cleaning today, our cleaning cycle then was relatively simple. The castings were required to come from the buffing room free of lodged or adhering tripoli. The colored castings were then:

1. Alkali dip cleaned—4 ozs. soda ash/gal.
2. Cold water rinse
3. Above two operations repeated
4. Cold water rinse
5. Cyanide dip
6. Cold water rinse
7. Cold water rinse
8. Plate

Absorption of Plated Metals by Zinc

A further contribution to the problem of plating on zinc-base die-castings appeared in an article, "Plating Die Castings," *The Brass World*, February, 1918, by the writer. The article points out that the cause of blistered nickel deposits having an undercoat of copper or brass is that the copper or brass is absorbed by the zinc, resulting in a blistering of the nickel deposit. Likewise, gold plated die-castings that had an undercoat of copper or brass, where subsequently the gold disappeared leaving a brown surface discoloration, was attributed to the same source.

Quoting from the article: "Zinc is a metal that has the property of absorbing other metals, notably copper, brass, gold, silver. Thus, when in nickel or gold plating die-castings, after first depositing copper or brass under the nickel or gold, and the copper or brass has been absorbed, the nickel blisters, while gold is further absorbed into the zinc, resulting in a brownish-grey surface on the die-castings. For this reason, die-

castings should never be copper or brass plated first. They should be directly nickel plated irrespective of what the finish is to be. Nickel has been found to withstand the absorptive properties of zinc." The above was one of the first published explanations of the absorptive properties of zinc, and must be considered along with the problem of black streaking. The article gave the following formula for the direct nickel plating of zinc-base die-castings:

Nickel Sulphate	40 ozs.
Nickel Chloride	5 ozs.
Sodium Citrate	4½ ozs.
Rochelle Salts	9 ozs.
Boric Acid	9 ozs.
Water	4½ gals.

The article makes the following statement: "There is no tendency for this solution to form black streaks when articles are left up to 15 minutes in the solution without current. The remarkable feature about this solution is that the plating can be carried on at 1.5 volts without black streaks, or at 3 volts for one-half hour without burning the deposit."

This solution was operated not only by the writer, but also other platers for a number of years successfully. The manner of replenishing the solution was to add from a stock solution made to the formula, with extra additions of boric acid to maintain proper acidity, the acidity being that of the solution as originally made up, and determined by titration with N/10 sodium hydroxide. Today, the pH of the original solution would be determined, and then maintained.

For a period of approximately four years, no literature of consequence was published investigating the plating on zinc or zinc-base die-castings, until *Traub* (Trans. E.C.S. 1922) published a confirmation of the writer's statement of the absorptive properties of zinc, and the ability of nickel to withstand being absorbed. Traub also established the fact that the diffusion of copper into zinc is more rapid at high temperatures.

There then followed a period of research activity on this subject, resulting in recommendations that have been adopted as current practice of today. The publications of these researches are listed below:

1. The Electro Deposition of Nickel on Zinc, by *A. Kenneth Graham*. Trans. E.C.S. 1923. Graham recommended that, since zinc requires a higher current density at the beginning of plating, zinc should be "striked" in a small solution kept especially for that purpose.

2. The Nickel Plating of Zinc-Base Die-Castings by *M. R. Thompson*. Trans. E.C.S. 1925. This paper is worthy of detailed consideration, as it has left a lasting effect upon current die-casting plating practices. Thompson reviewed the work of Hammond, and explained that the actual function or benefits of sodium citrate was that it formed a complex salt, and produced a high cathode polarization. High cathode polarization, Thompson stated, is the chief requirement of a nickel solution for plating on zinc, in addition to conductivity, efficiency, stability, and ease of control. Thompson justified the use of sodium citrate as an addition agent to deposit nickel on zinc, but stated that its disadvantages were: low throwing power, low cathode efficiency, high cost, susceptibility to decomposition, and difficulty of control by analysis.

Thompson's further experiments revealed that sodium sulphate, used in greater concentrations than sodium citrate, gave nearly as high a cathode polarization as sodium citrate, and that solutions containing sodium sulphate possessed greater throwing power, greater conductivity, and were easier to control. He recommended two baths:

	1	2
Nickel Sulphate	9.0 ozs.	19.0 ozs.
Ammonium Chloride	1.7 ozs.	1.7 ozs.
Anhydrous Sodium Sulphate	14.0 ozs.	28.0 ozs.
Boric Acid	2.1 ozs.	2.1 ozs.

Operating conditions:

a. 14-19 amps./sq. ft. on flat and simple shapes.
b. 33-37 amps./sq. ft. on complicated and recessed shapes.
c. Voltage 1.5-3.0
d. pH 5.5-5.8
e. Movement of cathode rod.

In concluding the review of Thompson's article, attention is called to the fact that Thompson did not consider the application of an undercoat of copper before applying nickel.

3. Nickel Plating of Fabricated Zinc in a Barrel by *Albert Hirsch*. Trans. Electrochemical Society, 1933. A description of a successful procedure used on sheet metal zinc articles.

4. Chromium Plating on Zinc by *M. de Kay* and *F. C. Jelen*. Trans. Eectrochemical Society, 1933. A review of corrosion tests of chromium plate on various preliminary deposits, in which it was brought out that the life of a chromium plate was proportional to the thickness of the preliminary nickel deposits; chromium plated on nickel from the sulphate bath gave only 70%-80% as long a life as when plated from the citrate bath.

5 A New Bath For The Direct Nickeling of Zinc by *George V. Nichols*. Trans. Electrochemical Society, 1933. It is brought out that lactates are effective in retarding the deposition of nickel on zinc by immersion. The article gives considerable experimental and technical data, without making any specific commercial recommendation.

6. A Study of Diffusion on Copper Plated Zinc Base Die Castings by *Wilhelm F. Castell*. Trans. Electrochemical Society, 1934. The result of this study, a repetition of Traub's (T.E.C.S. 1922) work, indicated that copper plated directly on zinc or zinc-base die-castings diffuses into the base metal at normal and elevated temperatures. At elevated temperatures the diffusion of copper takes place by forming different alloys with the zinc or zinc-base die-castings until all the copper is diffused, and the heavier the copper deposit, the thicker the diffused layer, and the longer the time

before a stable alloy is formed. However, the rate of diffusion at normal temperatures is slow, and it was claimed that it did not have any effect on the failure of the protective deposit. The failure of the deposit was claimed to have other causes, such as cleaning, occluded gas in the base metal, and porosity. It was claimed that a copper deposit .0002"-.0003" thick would be commercially satisfactory to withstand diffusion, before the deposition of nickel and chromium, and recommended this as a standard procedure for the plating of zinc and zinc-base die-castings. The primary reason given for the above recommended practice is that the author had found that nickel deposited directly upon zinc and zinc-base die-castings from the high sulphate or citrate baths was unsatisfactory, because the amount of nickel deposited from such solutions was limited, the deposit was brittle, and blistered after a short outdoor service with white zinc corrosion products appearing on top of the nickel deposit.

7. ZIALITE SOLUTION—PROPRIETARY SOLUTION FOR DIRECT NICKEL PLATING ON ZINC AND ZINC DIE-CASTINGS, marketed about 1934. Zialite Corp., Patent #2,069,566, 1937. An ammoniacal nickel solution containing pyrophosphates and citrates.

8. THE REACTIVITY OF ALUMINUM, ZINC, AND ZINC-BASE DIE-CASTING ALLOY WITH VARIOUS ELECTROLYTES by *J. V. Petrocelli* and *A. Phillips*. Trans. Electrochemical Society, 1944. Action of these metals studied in various electrolytes as effects possible results obtained in commercial practice. An explanation of the blistering of copper deposits from cyanide copper solutions offered, which was as follows:

"When the zinc-base die-casting is subjected to alkaline cleaning, either without the use of the electric current or when made cathodic, the aluminum-rich portions undergo dissolution in the electrolyte at a much greater rate than the zinc-rich portions. This tends to form pits on the surface which at times may extend through the denser surface layer into subsurface cavities, forming small channels leading into these internal cavities. Alkaline solution is then trapped in these pores and cavities. Concurrently, loosely adherent gelatinous aluminum hydroxide, a loosely adherent zinc deposit and deposits of other more noble metals, present in the alloy, will be formed on the surface. When the alloy is etched with mild acid solutions, the zinc-rich portions are preferentially dissolved. The general etching effect of both solutions enormously increases the true surface area. Acid solution may also be trapped in some of the pores. When the alloy is made cathodic in an alkaline plating solution, the gamma phase cannot be sufficiently polarized to prevent the aluminum from dissolving; thus, deposition on the gamma phase is taking place on a surface that is continually undergoing dissolution. Since the potential of the alloy is more electronegative than the metal being deposited, a considerable portion of the deposition is a displacement reaction. In the copper cyanide solution, hydrogen is evolved on the gamma surface as a result of the low overvoltage relationship, so that the above phenomena are augmented. The net result of these factors is poor adhesion and/or non-attachment of the deposit. Within the pores, pits, and exposed cavities, very little metal will deposit, but plating solution may be trapped in them and some loosely adherent gelatinous aluminum compounds are also formed on the surface of the gamma phase. Due to these factors a good portion of the electro-deposited metal on the gamma phase will cover the surface by a bridging process. The solution that is thus trapped underneath the plated metal will react with the basis metal producing hydrogen gas under pressure. This gas will then provide a lifting force on the deposit. Since the adhesion of the deposit on the gamma phase is poor, it will tend to lift at those areas. In the case of copper deposits we may have present a brittle brass diffusion layer which will yield to the force of the hydrogen.

The fact that hydrogen, produced by electrochemical action at the surface of some metals, diffuses into the metal has been well established. Since some investigators suspect that hydrogen absorbed in zinc-base die-castings during electrolytic treatment may be the cause of the blistering, an attempt was made to determine whether hydrogen does diffuse through the alloy during electrolytic treatment. The results of numerous experiments indicate that electrolytic hydrogen will diffuse through the alloy."

9. UNICHROME COPPER. United Chromium, Inc. Patent #2,250,556, 1941. Mildly alkaline (cyanide free) copper pyrophosphate solution, as a pre-coat to bright nickel and chorium deposits.

Present Day Plating Practice

Present day practice in the plating of zinc-base die-castings, while differing slightly in detail in many plants, runs fairly close to one of the following schedules:

1. Copper cyanide plate .0002"-.0003" in thickness. Then plate in a warm nickel solution (dull or bright) to produce a total deposit of .001" thick. The subsequent danger of the absorption of the copper deposit, and the formation of brittle copper-zinc alloys, with the possible blistering of the deposits as a result is ignored. While this method may allow the manufacturer to dispose of the goods from his stock without the deposits blistering, the ultimate result while in the hands of the consumer is questionable.
2. Direct nickeling of zinc in the high sulphate bath, for articles not used outdoors. However, experience has shown that this bath does produce black streaks unless a high current density is maintained throughout the entire plating, in which case frequent burnt deposits may be encountered.
3. Using the high sulphate bath as a strike and short time plating solution, and then transferring to a warm Watt's solution for a heavier and softer nickel deposit. This practice is primarily restricted, insofar as the writer has been able to

gather, to articles of simple shapes, free of deep recesses.

4. The use of an ammoniacal nickel solution, which permits the deposition of nickel direct on zinc and zinc-base die-castings without the use of preliminary striking.
5. The use of the pyrophosphate type copper bath, followed by a deposit of regular or bright nickel.

Discussion of Present Day Plating Practices

PROCEDURE 1.—Plate in regular Cyanide Copper, or Bright High-Speed Copper to .0002″-.0003″ thickness, and then nickel plate. The advocates of this method, while admitting the absorption of the copper deposit into the zinc base, state that .0002″-.0003″ in thickness will not be absorbed in the normal lifetime of the articles. That may be, but who is to state what is the normal lifetime? In addition, it is this writer's experience that there is more difficulty experienced by platers in plating from a copper cyanide bath, than by those platers depositing nickel direct. That difficulty is blistering, and regardless of the current opinion that it may be due to under cleaning or over cleaning, it has also been the experience of the writer, in using the same cleaning cycle, that copper plating produced blistered deposits, while nickel plating directly upon the zinc die-castings did not. This writer also feels that too much emphasis is today being placed for failure to successfully plate zinc die-casting on the cleaning or cleaners used. This blistering in itself would seem sufficient reason to condemn the copper deposit from a cyanide solution as poor technical practice.

In addition, the following statement is offered, which is in accord with the writer's experience and views, from no less an authority than the New Jersey Zinc Company from one of their bulletins:—"While the Copper-Nickel system enjoys widespread use in industry today, because of the greater throwing power of copper cyanide solutions, it is our strong belief that the all-nickel type of coating is to be preferred for the following reasons:

1. Nickel does not yield colored corrosion products. The advantage zinc has in being a white metal, and in giving white corrosion products is, therefore, retained by restricting the plated coating under chromium to nickel.
2. Nickel does not diffuse into zinc to form brittle alloy layers.
3. It is not difficult to avoid blistering in nickel deposits."

In addition, the writer would like to point out that copper as a preliminary coating is poor technical practice, because of the fact that the potential existing between Zn/Cu is 1.14 volts, while the potential between Zn/Ni is 0.47 volts, according to the Electromotive Series. This means that upon exposure to corrosion influences, the Zn/Cu deposit should fail much more rapidly than Zn/Ni deposits, at least in theory.

PROCEDURE 2.—Direct nickel plating of zinc in the high sulphate bath of articles not exposed outdoors. This bath has the disadvantage of being limited to thin deposits because the deposit tends to increase in brittleness with thickness, and unless high current density is maintained throughout the entire plating cycle, black streaking results. Frequent burnt deposits are encountered, but cathode motion, and/or continuous filtration will be found to remedy this. Advantages claimed for the bath are high throwing power, high conductivity, ease of analysis and control, stability, and low cost.

While the nickel citrate bath as recommended by Hammond has not been listed as one used in present day practices, it is desirable and advisable to discuss it at this point. Nickel solutions containing sodium citrate give the highest polarization, and can therefore be used at lower current densities than the high sulphate bath. In the personal experience of the writer, the citrate bath is a much safer bath to use than the high sulphate bath, for quality production. The disadvantages of low throwing power, difficulty to analyze and control, decomposition, and high cost do not stand up in actual practical application. The citrate bath of Hammond had never been given a fair industrial trial, in my opinion.

PROCEDURE 3.—Direct nickel plating of zinc in a high sulphate bath as a strike, and then transferring to a warm Watt's solution, for heavier and softer nickel deposits. Unless the articles are of simple shape without deep recesses, the permissable time for striking without resulting in a burnt deposit will be found to be insufficient, and upon being transferred to the secandary bath, black streaking will result, regardless of the current density used in the secondary bath. Should a high enough current density be used to cover the black streaking, the deposit will be found to be blistered either upon removing from the tank, or will blister upon chromium plating. In addition, the secondary nickel solution will be found to accumulate zinc quite rapidly.

PROCEDURE 4.—Deposition of nickel directly upon zinc from ammoniacal nickel baths. This solution also contains pyrophosphates and citrates. Its advantages are that nickel can be deposited upon zinc die-castings directly without any preliminary strike. The throwing power of the bath is excellent, so that deep recesses are readily covered, and consequently the solution of zinc from the recesses is very slight, Thus, the danger of zinc contamination experienced in other solutions is much lessened. This solution, in the experience of the writer, is an ideal solution to use as a preliminary deposit upon zinc and zinc die-castings, followed with a bright nickel plate, and then a chromium plate. Disadvantages stated against the bath, such as too difficult to control, decomposition products of citrates and pyrophosphates unbalance solution, and costs too much, are not, in the writer's experience with this solution, justified.

Should other finishes be desired, the ammoniacal nickel deposit can be followed with copper, brass, bronze, or silver.

PROCEDURE 5.—Pyrophosphate copper plate, followed by bright nickel and chromium plate. While the writer is definitely set against the application of copper upon zinc and zinc-base die-castings as the primary

coating, this survey would not be complete without discussing the application of the pyrophosphate copper bath. This bath has received wide application as an undercoat on zinc die-castings. While the application and use of this solution has been too recent to completely judge the results, very favorable results have been observed by the writer when compared to results that the same plants obtained when using cyanide copper baths. However, this in no way modifies the writer's opinion that nickel should be the proper primary deposit upon zinc and zinc die-castings.

Commercial Cleaning and Plating Practice

In presenting this survey, it is desirable that for completeness, there should be included information of current practices. To that end several large commercial cleaning companies were contacted for information on their recommendations for the preparation of zinc-base die-castings for plating, and several companies plating die-castings in large volume were visited, and their operations studied.

The cleaning companies were all remarkably in agreement on the proper manner of preparing zinc-base die-castings for plating. All agreed on precleaning in an emulsion cleaner, followed by dip alkali cleaner, and then anodic electric cleaner (no cathodic electric cleaning). The preceding flow chart listing essential steps, is a combination of the cleaning companies recommendations, and the observation of the plants visited whose operations were studied.

While the writer adheres to his present opinion that direct nickel on zinc-base die-castings is the proper initial coating, attention is called to the fact that no systematic study was ever made of the absorption of a brass plate by zinc or zinc-base die-castings. The assumption is that since a brass plate contains zinc, the rate of absorption or the degree of absorption is less than that of a copper deposit. This may or may not be true. To this end experiments are in progress, with and without brightener agents in the brass baths. Also additonal experiments on the direct nickel plating of zinc-base die-castings are being carried out, attacking the problem from a different angle. The result of these experiments will be published when completed.

FLOW CHART

Operation	Description	Details
1	Fine grease to remove parting line.	#240 abrasive, usually.
2	Cut-Color.	
3	Inspect and rack.	Positive spring contacts.
4	a) Emulsion cleaner.	
	b) Hot water rinse.	Spray rinses preferable.
	c) Alkali dip.	
	d) Hot water rinse.	
	e) Cold water rinse.	
4	(Alternate) Degrease in Vapor Degreaser.	
5	Electric Clean.	Anodic-6v.—½-1min @ 160°F.
6	Rinse.	
7	Rinse.	
8	1% Acid Dip.	Sulphuric, Hydrochloric, or Hydrofluoric Acids.
9	Rinse.	
10	Rinse.	
11	Copper strike (cyanide bath).	pH 11.0-11.5 @ 120°F.
12	Rinse.	
13	Rinse.	
14	Copper plate in high speed bath.	Time dependent on thickness wanted. If periodic reverse is used direct 6 sec., reverse 1 sec.
15	Rinse.	
16	Rinse.	
17	Acid dip.	Sulphuric Acid 5%.
18	Rinse.	
19	Bright nickel.	
20	Rinse.	
21	Acid dip.	Sulphuric Acid 1%.
22	Rinse.	
23	Chrome plate.	
24	Dragout Rinse.	
25	Cold Rinse.	
26	Hot Rinse.	

Bibliography

In addition to papers and articles referred to in the survey, the following are recommended for reference:

Plating of Die Casting on Full Automatic Conveyor. H. A. Schoonover. Metal Finishing, July 1935.

Modern Practice in Plating Zinc-Alloy Die-Castings. W. W. Broughton. A.E.S. Monthly Review, May 1940.

Finishing Base Metal Die Castings. J. E. Charleson. A.E.S. Review, 1939.

Cleaning and Plating of Zinc Alloy Die Castings. E. C. Rinker Oakite News, 1938.

Multiple Nickel Plating on Zinc. E. H. Anderson. A.E.S. Review, June 1935.

Improved Finishes for Die-Castings. Joseph C. Fox. Doehler Die Casting Company, brochure.

Plating Zinc-Alloy Die-Castings Commercially. E. A. Anderson. Metal Cleaning and Finishing, July 1938.

Plating of Zinc-Base Die-Castings. D. M. Overcash. A.E.S. Review, July 1946.

Finishing of Rolled Zinc and Zinc Alloy Die-Castings. Dr. A. C. Elm Metal Finishing, June 1941.

The Finishing of Zinc Alloy Die-Castings. New Jersey Zinc Company, 1945 Edition.

Detroit Branch– Symposium on Zinc Die-Castings—three (3) papers A.E.S. Review, March 1946.

Electrolytic Cleaning of Zinc and Zinc Alloys in Alkaline Baths—A.E.S. Review, April 1946.

Electroplating Zinc-Base Die-Castings—C. F. Nixon. Metal Finishing, March 1947.

Industrial Plating of Zinc-Base Die-Castings—Charles Temple. Metal Finishing, July 1947.

Symposium on Plating on Zinc-Base Alloy Die-Castings—Plating, February 1948.

Plating Zinc Die-Castings at Gerity—Michigan—William MacLeay. Iron Age, July 1948.

High Pressure Sandblasting

By Joseph Albin, *New York, N. Y.*

Rigorous control of sand and timing dovetail with operating at higher air pressures to expedite a variety of cleaning jobs in an airlines maintenance shop.—ED.

FORCING SAND at 80-100 lbs. air pressure onto the surface of castings might be considered satisfactory in come cases; the cleaning is accomplished in a minimum of time, and what scoring or pitting may occur might not be objectionable. However, considerable trial and experience was required in using such high air pressures in cleaning a wide variety of aircraft parts, some of them very critical in nature and dimensions, in the overhaul maintenance shop of American Airlines.

The object of the supervisors of the maintenance shop was to have a blast cleaning set-up that could handle the wide variety of jobs from all the maintenance departments at the base without having to train a special operator who would do all the blast cleaning,

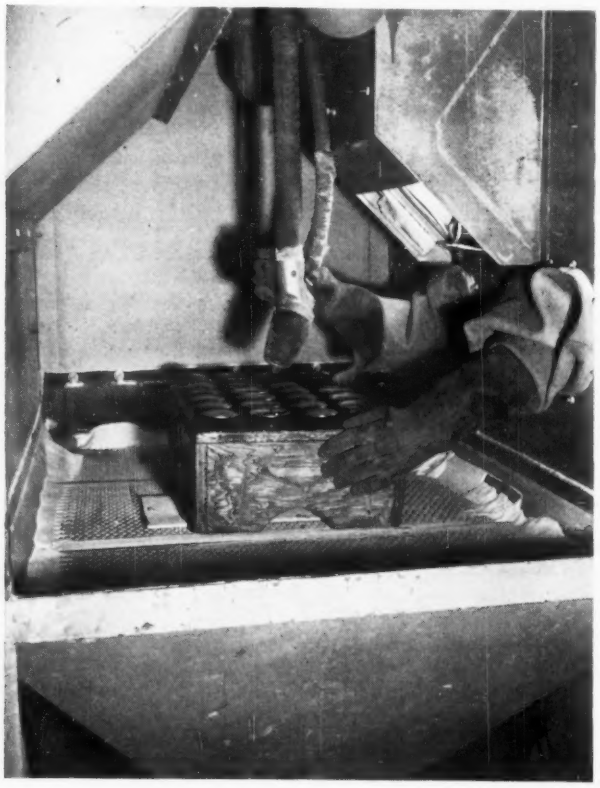


Figure 1. Blast cleaning of engine valves during regular overhaul, using high pressures to affect cleaning and polishing.

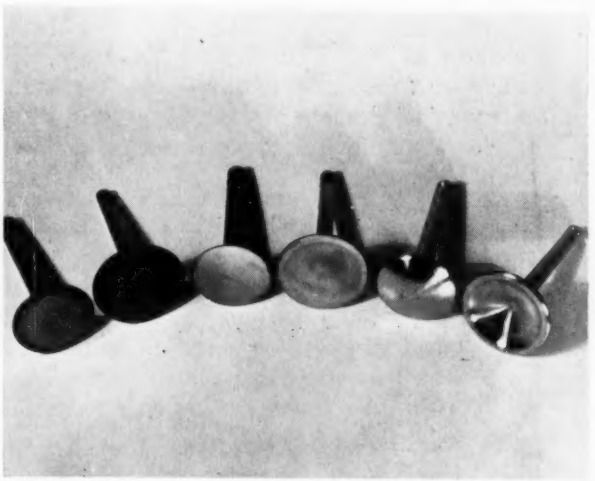


Figure 2. Showing the progress of cleaning. Valves on left are as removed from the engine, center after blast cleaning, and right are new valves.

and with a minimum of adjustment required at the machine. It was desirable to have any one of the maintenance shop personnel operate the equipment, due to the irregular and spasmodic nature of the work load for this type of cleaning.

For instance, a member of the plating shop might bring in a box of coupling gears for sandblasting away the hard chrome plating, in preparation for replating according to a rigid specification of the Airlines engineering department. Formerly this job was done at a pressure of 20 lbs., resulting in an exceptionally long and exhausting cycle to strip off all the chrome. It was felt, however, that such low pressures were the only means of insuring that over-application of the sand stream to an area already stripped of its chrome would not result in excessive pitting and erosion, as it was quite difficult for an operator to tell exactly when the chrome had all been removed from any given area. Tieing up production was inevitable, and there was the ever-present danger of ruining an expensive engine part. This job is now done in a few minutes at 80-90 lbs./sq. inch pressure.

Another difficult cleaning job which is delegated to

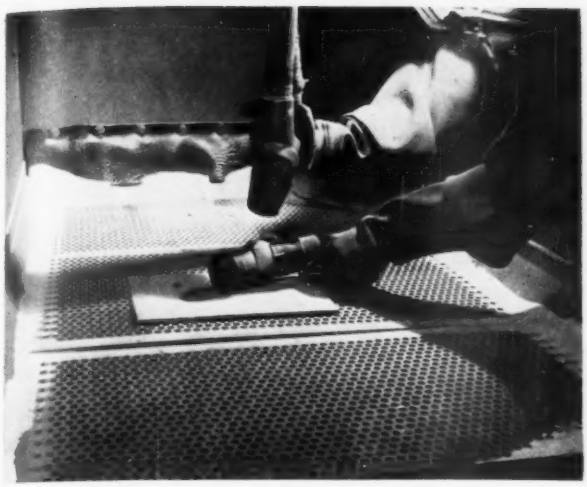


Figure 3. Cleaning stainless steel exhaust coupling. Note rubber cover over blast nozzle to prevent damage to parts thru collision.

the blast cleaning machine is the cleaning of hardened deposits of carbon and burned scale from engine parts and the stainless steel parts of the exhaust systems. This is now being accomplished quickly and easily with air pressures of 100 lbs./sq. in. A typical part of this nature is the exhaust engine valves shown in Figure 1. A frosted surface is produced in the high pressure sand blasting operation after incrustations have been removed, as shown in the photograph of Figure 2. This frosted surface is considered entirely satisfactory for this particular part, and the former polishing of the valves is no longer required for proper engine performance. In connection with this type of frosted surface, American Airlines engineers have decided that the highly polished surface formerly produced on cylinder walls was not conducive to proper functioning of the lubricants, with seizure often occurring. This type of surface is now lapped instead of polished.

Figure 3 shows a coupling from the exhaust system of an aircraft engine. This type of part develops in service a hard incrustation of carbon and scale, due to the high temperatures involved. In order to reach all the interior areas, this coupling is first dis-assembled.

Figure 4. Dis-assembled view of exhaust coupling, showing conditions of internal areas.

as shown in Figure 4. Sand blasting these parts at 90 lbs. has proven entirely satisfactory, and the necessary snug fit between mating parts has been maintained.

Incidentally, one of the critical parts that cannot be cleaned by sandblasting at these high pressures is the aluminum alloy cylinder heads. These must be cleaned by "soft-grit" methods to prevent excessive erosion (See Metal Finishing, March 1948 "Cleaning Metal Surfaces by Non-Erosive Blasting").

As previously stated, much trial and error experimentation was carried on until just the right type of abrasive action was produced at these high blasting pressures. The most important consideration, it was found, was in the type of sand used. After many trials, a pure white silica sand was adopted. The characteristics desired were that the grains be rounded, not sharp, and that they be hard enough to resist fracturing, which leads to excessive loss through "dusting". Of paramount importance is the fact that the sand must always be kept clean and dry. The mesh of the grains is 40-50. Any number of other types of sand have been tried, but sand meeting the above

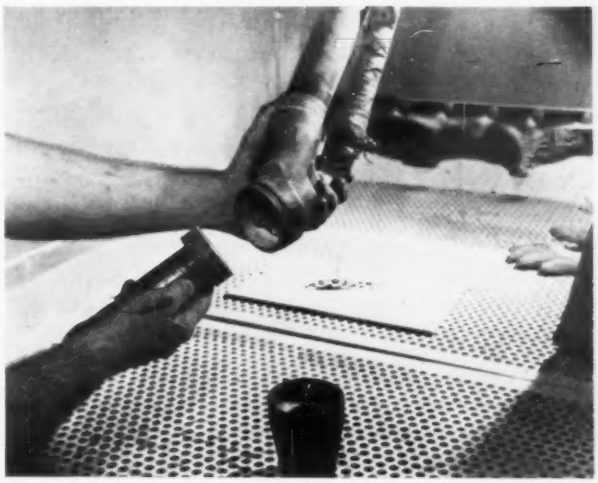


Figure 5. Replacing special nozzle. Rubber cap is at bottom center.

specifications has proven superior at high blast pressures. Using this sand, about 15% is lost through powdering and dusting weekly.

At these high pressures, ordinary blasting nozzles are worn away rapidly, consequently a special carbide type nozzle has been adopted as standard. One nozzle of this special abrasive-resistant product has been in service for over eight months without showing signs of appreciable wear. Because of the slow gradual wear, the abrasive stream contour exhibits only the very slightest change. The narrow spray stream contour brings about more positive indication of areas already cleaned. A nozzle of one-half inch diameter is used (see Fig. 5). The maintaining of constancy in stream concentration furthermore permits specifying of definite air pressures for particular cleaning jobs.

Utilizing otherwise standard sandblasting equipment, airlines maintenance personnel have thus eliminated some of the variables involved in effecting faster cleaning as well as good control of the eroded surface.

Adsorption Phenomena in the Plating Room

By H. A. Fudeman, *Process Engineer, Trico Products, Buffalo, N. Y.*

ADSORPTION phenomena have been studied since as early as 1773, with the consequent evolution of processes which have become essential industrial tools. Although the field of electroplating has benefited to some extent by the use of adsorptive forces, they also seem to present an approach of the explanation of some of the more distressing problems in the plating room. It is the purpose of this paper to present the basic concepts of adsorption, with an eye toward establishing its significance in the plating room.

Generally, adsorption represents that force whereby gases and vapors are held by the surface of a solid without intimate mixture of the gas or vapor molecules with those of the solid (or adsorbent). This should not be confused with *absorption*, whereby gases or vapors mix intimately with the solid (or absorbent) and penetrate it, often effecting a change of state in the absorbent.[1]

For example, silica gel has an affinity for water vapor, but the amount of water it can take up seems to be limited by its surface area and is entirely independent of the mass; this is adsorption. Calcium chloride also has an affinity for water vapor, but the amount taken up is a function of the mass. Also, analysis shows that the anhydrous calcium chloride changes to the hydrate, $CaCl_2.2H_2O$. Even after the hydrate is formed, the taking up of the water vapor continues, often effecting the solution of the salt. Thus, here we have an example of absorption which follows to the letter the definition given earlier.

Many theories[2, 3, 4, 5, 6] have been advanced to explain adsorption, but none of them have proven to be irrefutable. The trend of experimental evidence, however, seems to indicate that since adsorption takes place at the surface of the solid, it follows that the attraction of gases and vapors can be attributed to the surface activity of the solid. Thus, in a solid body, atoms within the body have a mutual attraction for each other. The atoms near the surface of the body, however, are subjected to unbalanced forces, the inner pull being greater than the outward forces, but still leaving some unsaturated forces at the surface of the body. Thus, a tendency exists in the body whereby the surface is decreased, creating surface tension, just like in a liquid. Any process that tends to decrease free surface energy (surface area x surface tension) occurs spontaneously. This phenomenon is readily demonstrated in liquids, which, because of their surface tension tend to keep their surface areas as small as possible, thus consequently reducing the free surface energy of the liquid. The capillary phenomena (i.e. meniscus formation, spherical drop formation, et.al.) are further manifestations of free surface energy reduction in liquids.

In solids, on the other hand, we have bodies which are relatively rigid because their atoms and molecules are more or less fixed into crystal lattices, rather than in a random agglomeration, as is the case with liquids. Thus, the free surface energy of a solid is a function of the forces existing between the crystals, and therefore the unsaturated forces at the surface of a solid arise from the exposed crystal faces of a solid. Also, compared to liquids, solid surfaces are rough, which presupposes the increased exposure of crystal faces with

The Author

Mr. Fudeman is graduate of Alabama University. For several years he was Chief Chemist for Acme Steel & Malleable Iron Works, and during the war was conducting research for Linde Air Products, working on the Manhattan Project. Since then he has been with Trico Products as a plating chemist and process engineer.

increased roughness and consequently increased free surface energy. The free surface energy on a solid is almost invariably reduced by adsorption of gases and vapors. Such adsorption on solid surfaces is spontaneous, since it has been demonstrated that no solid surface is free of adsorbed vapors or gases. In fact, any efforts to remove adsorbed films from metal surfaces by grinding or other methods have been futile because adsorption layers of gases and vapors form immediately on every surface of freshly exposed metal.

Mantell[2] illustrates the versatility of adsorption by stating that it concerns itself with the concentration, as a result of surface forces existing on a solid, of gases, vapors, liquids, solutes and dispersed materials (colloids).

All adsorption processes are exothermic[3] (give off heat), because of the loss of energy involved in the restriction of the molecular motion from three dimensions to two dimensions. This is called *heat of adsorption* and has been found to be relatively specific for a given reaction. Also, available evidence indicates that the amount of gas or vapor adsorbed per gram of adsorbent at equilibrium is a function of temperature, pressure, and the nature of the adsorbent (surface area, size, shape and extent of pores) and the adsorbed molecules. The rate of adsorption is usually very rapid and increases with temperature.

The physical properties of a gas seem to indicate that they are correlative functions of the amount of gas that can be adsorbed by a given adsorbent. Table 1, taken from *Brunauer*[3], shows the adsorption of various gases on charcoal.

Such data as was obtained by various investigators on the adsorption of gases showed trends similar to those observed in Table 1, with the conclusion that the amount of gas adsorbed by a given adsorbent increases as its boiling point and critical temperature increases. That is to say, the gases which are most readily condensible are most readily adsorbed by a given adsorbent.

The same holds true for liquids and vapors.[4] This is substantiated in Table 2 by data presented by *E. J. Miller*[7] which includes adsorption data for several organic acids on blood charcoal (from an .01M solution of the acid using .25 grams of charcoal in a 100 cc. sample of solution). It is interesting to note, from the table, that the adsorption also increases as the size of the molecules increases.

Table 1

Adsorption of Gases by Charcoal
1 gram of adsorbent at —15°C

Gas	Volume Adsorbed	Boiling Point of Gas	Critical Temperature
$COCl_2$	440cc	—8°C	183°C
SO_2	380	—10	137
CH_3Cl	277	—24	143
NH_3	181	—33	132
H_2S	99	—62	100
HCl	72	—83	52
N_2O	54	—90	37
C_2H_2	49	—84	36
CO_2	48	—78	31
CH_4	16	—164	—87
CO	9	—190	—140
O_2	8	—182	—118
N_2	8	—195	—146
H_2	5	—252	—241

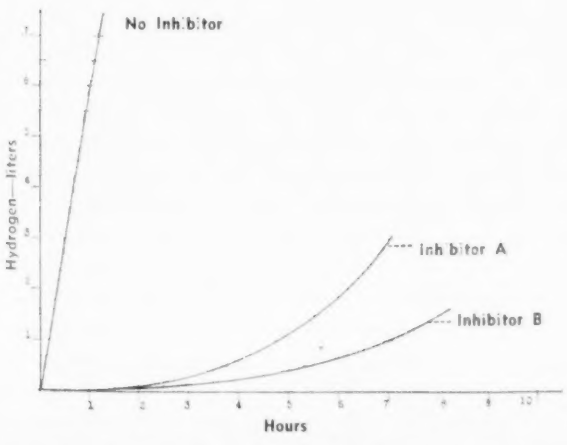


Figure 1. The effect of inhibitors on the amount of hydrogen evolved in pickling baths.

It is well at this time to mention that adsorptive forces, in some instances, can be neutralized or modified by a phenomenon known as *desorption*. That is to say, materials which have been adsorbed upon a solid body can, under proper conditions, be removed from the body by desorption. The particular neutralizing effect of desorption is a function of the properties of the adsorbent and adsorbate. Some of the most typical desorption methods are:[5]

1. Evacuation of adsorbed systems.
2. Substitution of a more adsorbable material to release desired material.
3. Steaming.
4. Change pH of solution.
5. Solvent extraction.
6. Electrodialysis.
7. Chemical reaction.

There are undoubtedly other methods of desorption, but the subject is sufficiently complex at present to necessitate individual studies of each specific case in question as it occurs.

The foregoing summary is not intended as a complete thesis on adsorptive proceses; however it is hoped that sufficient information is given to present a general concept of adsorption phenomena. With these ideas in mind we can begin to interpret the role played by adsorption in the plating room.

Adsorption Applied to Plating

Active Carbon

Every plater who has used any of the organic type bright nickel baths should be familiar with the use of active carbon. Active carbon has long been known for

its ability to remove organic impurities from plating baths. Specifically, purification with active carbon merely involves selective adsorpiton of organic materials by filtration of the bath through a cake of carbon in the filter.

Pickling Inhibitors

The pickling of steel with mineral acids to remove rust and scale is general practice. However, if the pickling operation is not watched closely, the metal surface will continue to be attacked after the scale has been removed, causing loss of metal as well as deterioration of surface appearance by pitting. An added complication of overpickling is the tendency toward hydrogen embrittlement which occurs because of hydrogen evolved in the pickling bath being absorbed into the metal being pickled.

Research has led to the development of complex organic materials which serve as inhibiotrs in pickling baths, preventing attack on the steel. These inhibitors also tend to greatly minimize hydrogen embrittlement by reducing the volume of hydrogen generated during the pickling operation. This is illustrated in Figure I which shows the effect of inhibitors in a pickling bath upon the volume of hydrogen evolved.[8] These inhibitors are usually adsorbed selectively on the steel and will not go into action until the bare steel begins to show through the scale or rust. Wherever inhibitors are used in pickling baths, rust and scale removal is facilitated and parts come from the bath smooth and free from pitting. The adsorbed film also tends t inhibit to some extent further rusting of the steel until it is racked and ready for plating. Desorption of the film is effected readily in any good alkaline anodic cleaner.

An interesting example of the efficacy of inhibitors in acid pickling baths is called to mind in the case of a small die which had developed scale during heat treatment. The die was racked and placed in a hot sulfuric acid pickle containing an inhibitor. By accident, the die fell off the rack to the bottom of the tank and lay there for three days. When the bath was finally dumped the die was removed from its resting place free from scale, free from pitting and free from any discernible dimensional discrepancy.

It should be added that some success has been achieved also in the development of inhibitors for copper, brass and bronze. Similarly, cleaning compounds for metal washing machines have been developed which leave an adsorbed film of oil on steel surfaces to inhibit rust.

Table 2

Adsorption of Organic Acids by Purified Blood Charcoal

Acid	cc's Adsorbed	Boiling Point °C
Acetic	15.7	18.1
Butyric	35.4	163.5
Valeric	49.4	187.0
Caproic	62.1	202.0

(Courtesy Amer. Cyanamid Co.)

Figure II. Cartridge type water de-ionizer for small quantity production of mineral-free water.

Film Formation

All metal surfaces, regardless of whether they are base metals or electrodeposited metals, have a certain amount of inherent porosity. Thus it seems reasonable that metal surfaces would show tendencies toward adsorption which would vary quantitatively with the specific nature of the physical structure of the surface; that is to say, a smooth surface would tend to adsorb less than a rougher surface. This is substantiated somewhat in the work of *Armbuster*[9] and *Griffin*,[10] who studied sorption of gases on metal powders and smooth metal foils. They found that where sorption of gases on metal powders was significant, it was almost immeasurable on the smooth materials.

Jacquet[11] describes what he calls absorption films on metal surfaces such as copper, nickel, iron and platinum, which he attributes to certain hydrophilic colloids (proteins and their disintegration products), which films materially reduce adhesion of electrodeposits to such surfaces. It is the opinion of this writer, in accordance with the definitions presented earlier, that adsorption, not absorption, is the force involved.

Johnson[12] describes similar films due to proteins taken into solution from wooden barrels and tanks.

An example of film formation that might be attributable to adsorption was observed by this writer recently. Zinz die-cast parts plated on a copper, nickel, chromium conveyor were showing dull, streaky areas after plating. The occurrence of the dullness did not seem to be a function of position on the rack since it occurred in high current density areas just as frequently as it did in low current density areas. Attempts to remove the "stains" by buffing the chrome were unsuccessful. The dullness could be removed by stripping the chrome, buffing the nickel and re-plating.

It was noted that the bright nickel bath (an organic addition-agent type) during this period was forced to forego the regular purification treatment with active carbon because of the pressure of production, and was running overtime. Unquestionably, the bath was con-

taminated with decomposition products of the organic addition agents. This is substantiated by the fact that the expected quota of "orange peel" showed up among the rejects. By placing a 10 per cent sulfuric acid dip after the nickel bath the dull streaky deposits were eliminated. The "orange peel" persisted, however, until the bath was purified.

From the above, is seems logical that some of the castings presented a porous surface which might have been favorable for the adsorption of some of the organic decomposition products. The streaky, haphazard appearance of the film itself might be a function of the distribution of the pores on the casting surface. Also, it is obvious that the sulfuric acid dip effected a complete desorption of the film, and since it has been in use, the dull spots have not recurred.

Ion Exchange

Ion exchange has been defined as a reversible interchange between ions of a solution and those ions adsorbed on the surface of a solid. The development of ion exchange materials[13] began in 1850 with the observation by *Way* that solutions of potassium chloride when passed through a bed of soil would cause the removal of potassium ions from the solution which were replaced by equivalent amounts of calcium and sodium from the soil. The major developments in the field of ion exchange were made in the twentieth century. The first commercial zeolites, complex mineral silicates, were introduced in 1905 as water softeners. Through the years, many synthetic zeolites appeared which had improved ion exchange properties. The development of certain synthetic resins in 1935 led to selective adsorption of anions and cations from solutions, which greatly expanded the possibilties of ion exchange for the purification of solutions.

At the present time a great variety of cation and anion exchange resins are available for general use in water treatment, and the development of de-ionizing equipment has kept pace with the development of the resins. For example, in Figure II is shown a small cartridge type deionizing unit which is capable of delivering at the rate of ten gallons per hour, water which is the chemical equivalent of distilled water (less than ten parts per million of ionized solids). The unit is equipped with a sensitive ohmmeter which indicates at a glance the purity of the water emerging from the discharge end of the unit. Such simple operation and control is also available in units which are designed to deliver as much as one thousand gallons of de-ionized water per hour.

With the increased emphasis in recent years on the effects of impurities in plating solutions, it has been demonstrated[14] that water can be responsible for the introduction of such metallic impurities as calcium, magnesium, copper, etc. Various anions such as $-CO_3$, -Cl, $-NO_3$, $-SO_4$, can also be introduced in the water, with deleterious effects on the electrodeposits or the general operating efficiency of the plating bath. It has been ascertained that concentrations of the aforementioned impurities in a plating bath as low as 0.1 of a part per million can impair the quality of an electrodeposit.

Hard water, or more specifically, the calcium and magnesium salts dissolved in water, have often been neglected as a cause for blistering, poor plate quality, lowered deposition rate, and sludge formation in plating baths.[15] It is also known that calcium and magnesium salts, when introduced into alkaline cleaners, reduce their life and efficiency. Burnishing barrels sometimes develop sludges when calcium and magnesium salts react with the alkalis contained in burnishing compounds.

Such findings should provoke some thought of the value of de-ionized water in the plating room. Despite the obvious advantages of de-ionized water, these advantages must be weighed against the operating cost of the de-ionizer. In hard water areas, a de-ionizer may pay dividends; such advantages are doubtful in areas where the water hardness is eight grains per gallon or less.

In summing up, we have observed that adsorption is a versatile force which can serve to help or hinder progress in the plating room. It is expected that recent developments relative to the effects of impurities in plating baths will lead to the development of improved methods of bath purification in which adsorption will play a prominent part. It seems probable that as more becomes known about the porosity of electrodeposits, some information will be forthcoming concerning the adsorbent nature of such surfaces. This undoubtedly will lead to a more thorough evaluation of finishing procedures prior to plating. On the whole, it seems that as the significance of adsorption in the plating room is realized, the plater will have acquired a tool which will help him to understand certain variables which may still be a deep, dark mystery to him.

Bibliography

1. J. J. Bikerman—*Surface Chemistry*, pgs. 1-20 & 164-184.
2. C. L. Mantell—*Adsorption.*
3. S. Brunauer—*The Adsorption of Gases and Vapors*—Vol. 1—Princeton University Press 1943.
4. E. Ledoux—*Vapor Adsorption*—Chemical Publishing Co. —1945.
5. J. W. Hassler—*Active Carbon—The Modern Purifier*—Ind. Chem. Sales Div., W. Va. Pulp & Paper Co. 1941.
6. Getman and Daniels—*Outlines of Theoretical Chemistry* pgs. 220-226.
7. E. J. Miller—*Colloid Symposium Monograph*, 5:50 (1928) Reinhold Publishing Co.
8. Communicated by A. J. Saukaitis, American Chemical Paint Co.
9. Armbruster—*J. Am. Chem. Soc.*—64:2545 (Nov. 1942).
10. Griffin—ibid—64:2610 (Nov. 1942).
11. Jacquet—*Trans. Am. Electrochem. Soc.*—66:393 (1934).
12. Johnson—*Proceedings A.E.S.* (1936).
13. V. R. Dietz—*Bibliography on Solid Adsorbents* 1900-1942 pg. lxviii—Nat'l Bureau of Standards.
14. F. R. Morral—*Metal Finishing*—Nov. 1946.
15. R. S. Herwig—*Iron Age*—March 27, 1947.

Future Outlook for Metals Used in the Plating Industry

THE following figures and comments on the future outlook for the various metals of interest to electroplaters were taken from a report published by the *Economic Cooperation Administration* for the European Recovery Program. A complete copy of the report is available giving the outlook for other metals, including aluminum, titanium, antimony, tungsten, and molybdenum.

Copper

No significant increase in world copper production is expected in 1949, particularly in the United States, because of substantial production already lost as the result of labor difficulties at one of the major producers. In 1950 and 1951, however, as projects for increased output now under way in Butte, Mont., and San Manuel, Ariz., begin to make their contributions to supply, the situation in the United States can be expected to improve.

Plans at Butte call for gradual increases with ultimate production by 1952-53 of about 30,000 metric tons a year. Chilean production will also be maintained by long-range plans for the mining of sulfide ores by the Chile Copper Co. beginning some time in 1952.

In Europe only minor production gains are hoped for. Austria proposes to install a plant for the treatment of domestic ores at Mitterburg, which should increase annual output by about 3,000 metric tons. An extension of the refining capacity at Brixlegg to deal with this increased production is also proposed. Some increase in Bizone Germany production is anticipated by 1952-53, particularly as the result of the resumption of traditional treatment of concentrates from Cyprus, where mining operations have been rehabilitated.

The overseas territory of the participating countries are expected to make a much more important contribution to supplies. In Northern Rhodesia the United Kingdom is planning to increase output from the present 236,000 metric tons per year to 305,000 metric tons by 1953, with a possible addition of 50,000 metric tons annually after 1953, through increased mine production and extension of the local refinery capacity. The Belgian Congo also proposes to increase production from the current rate of 150,000 metric tons a year to 162,500 metric tons by 1953. These developments will tend substantially to reduce the requirements of Europe generally for Western Hemisphere copper.

Lead

No substantial increase in world lead production can be looked for in the immediate future—not because of any lack of smelting capacity, but rather due to a world-wide shortage of lead concentrates, a condition which is not expected to improve substantially in 1949.

There is little hope for any substantial increase in lead production from the United States and other Western Hemisphere countries during 1949, as mining operations there appear to have leveled off. Future increased production will depend to a large extent upon increased imports of concentrates.

The present production in Europe is substantially lower than before the war. This is due to the general deterioration of mining plants throughout Europe—especially in Germany. Another factor that decreases the amount of lead available to the participating countriaes is the elimination of Yugoslavia as a source of supply. The OEEC, however, estimates that the participating countries and their overseas territories will produce 500,000 metric tons of lead in 1952-53—or about twice that of ECA estimated production in 1948.

There are a number of areas which could provide substantial amounts of metal. For example, a combination of French and American capital is carrying out mine development in the Zellidja District in the northwest corner of French Morocco, and a new smelter of 25,000 metric tons capacity is being completed in Ouidja.

In Bizone Germany, mines are now operating at a fraction of their former capacity due to inadequate working capital and equipment. The ECA is initiating action to furnish whatever assistance it can to obtain increased production there. Recently a new property —Maubacher-Bleiberg mine near Duren, west of Cologne—has been developed. Explorations indicate a total ore reserve of about 28,000,000 metric tons averaging 3 per cent lead and 2 per cent zinc or a recoverable metal content of about 700,000 metric tons of lead and about 360,000 metric tons of zinc. During the past 2 years ore treatment tests have been made and a flotation plant to treat 400 metric tons a day is being constructed. Based on the results in this mill, a new plant with 3,000 tons daily capacity may be built and this should yield 20,000 metric tons of lead and 8,000 metric tons of zinc, according to recent reports.

There are other possibilities for increasing production or developing new mines in Italy, Austria, Greece, and the United Kingdom. In Greece, for example, at

the Greek Laurium mines southeast of Athens, there are a few million tons of sand tailings left from previous operations. These are said to contain 3 per cent lead and 3 per cent zinc; also a few million tons of ore with 6 to 8 per cent lead and 5 to 7 per cent zinc are still to be mined. The most promising lead development possibility in the United Kingdom is in the overseas territory of Tanganyika, where it is reported that the proposed Uruwira mine might produce some 20,000 metric tons of lead per year.

Zinc

The future world outlook for increased production of zinc is encouraging. In the United States some increased production, perhaps as much as 45,000 metric tons, can be anticipated in 1949, as a result of planned domestic smelter expansion. No difficulty is anticipated in supplying this additonal smelting capacity with imported concentrates, since there is at present a world surplus. Also, some increase is expected in the output zinc concentrates from Canada.

In the participating countries, production, now slightly below prewar, is expected to show some improvement in the immediate future. In 1952-53 a very substantial increase has been estimated, based largely upon a greater Belgian and German production.

It is believed that the Belgian increases will not be derived from an increase of zinc concentrates from the Western Hemisphere and Australia, but from properties in the Belgian Congo, now suffering from inadequate railroad service.

A restoration of Bizone Germany's prewar zinc production would add substantially to the European position. The most important zinc-lead mine in western Germany is Rammelsberg, near Goslar in the British Zone. Ore reserves are estimated at 6,000,000 metric tons containing 14 percent zinc, 9 percent lead, 1 percent copper, and 5 ounces of silver per ton. Concentrates from this mine are shipped to a smelter at Oker, where production up to 1944 amounted to about 35,000 metric tons of slab zinc and 20,000 tons of pig lead per year. Neither the mine nor the smelter were damaged by the war, but recent reports indicate that while production is currently at or near normal capacity, further expansion could be effected under proper conditions.

Opportunities for increased production also exist in other European countries. In Italy, modernization of plant and mining methods will permit the mining of large quantities of low-grade ores heretofore not developed. France and Austria are also preparing expansion of their mines at home and abroad.

As in the case of lead, Europe is suffering from the loss of zinc metal which normally was furnished by Poland and Yugoslavia.

Cadmium

The world production-consumption position of cadmium during 1948 was fairly tight. (This will not be news to most platers. Ed.) The future outlook for increased production by 1952-53, is fairly encouraging. Cadmium is produced as a byproduct of zinc smelting and refining.

In the United States, production in 1948 amounted to an estimated 3,400 metric tons—or slightly below that for 1947. This was largely the result of reduced imports of flue dust and the temporary loss by one producer of certain zinc smelting and refining facilities due to labor difficulties. Because of these shortfalls and continued consumer demands primarily for plating, bearing alloys, and pigments, the price of commercial sticks advanced from $1.75 a pound to a high of $2 a pound late in the year.

In the participating countries, plans by the French to install new zinc smelting capacity totaling about 40,000 metric tons by 1952-53, using the New Jersey Zinc Co.'s vertical retort and refining processes in replacement of old plants of theoretically equivalent capacity, will result in additional byproduct cadmium production, since their old plants and processes were not equipped economically to handle high cadmium zinc concentrates. Plans for additional zinc smelting and refining capacity in Austria, Italy, and modernization of certain existing facilities in the United Kingdom by 1952-53, should also result in additional byproduct cadmium production.

Nickel

The world supply of nickel, excluding Russia and satellite countries, depends almost entirely on the Canadian output; minor quantities are produced in the French colony of New Caledonia, the United States, and Europe.

In order to take care of the United States requirements, now at a peacetime high, Canadian production in 1948 increased approximately 10 percent above that of 1947. Reports from Canada indicate further increases in 1949 but the past summer's drought condition has cut down the available electric power to such an extent that this may not be possible until the spring of the new year. Meanwhile the 1948 rate will probably be maintained.

The 1948 output of New Caledonia was less than in 1947 due to changes in metallurgical plant and difficulties in obtaining sufficient coal for smelting purposes. Adequate coal supplies have now been made available from outside sources with ECA financial assistance, and it is believed that by 1952 production will have risen from the present annual rate of 3,000 tons to 11,000 metric tons which will probably be sufficient to make France independent of nickel imports from Canada.

Tin

The world production of tin metal has made a steady recovery since the end of the war and is estimated at 152,000 metric tons for 1948, as compared with 126,000 metric tons in 1947, and a yearly average of 170,000 metric tons for 1935-38.

The improvement of the tin situation has been stimulated by high prices but is chiefly attributable to the recovery in production in Malaya and Indonesia which, if maintained, will by 1950 restore the output of tin to prewar levels. Continued disturbances in the Far East, however, might react very unfavorably on the United States tin supply.

Shop Problems

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Test for Hydrogen Embrittlement Failures

Question: We have recently run into several failures of zinc and cadmium plated steel springs. We suspect that some of these failures may be due to hydrogen embrittlement, although the springs are normally baked for four hours at 400 F after plating. Is there any test for proving whether or not such failures were due to hydrogen embrittlement or some other cause?

C. E. M.

Answer: As far as we know, there is no way of positively determining whether or not hydrogen absorption was responsible for this type of spring failure. A metallographic examination of the parts may reveal pitted or otherwise defective raw material. The baking cycle you are using should be sufficient to eliminate any hydrogen absorbed during plating. The parts should not be flexed or otherwise distorted after plating and before baking, as cracks may be started that could result in early failure of the springs in service, in spite of the complete elimination of any hydrogen during the baking cycle.

Nickel Plating Blued Steel

Question: I want to produce bright nickel plated stovepipes, using the present steel which has a very smooth, dark blue finish. In attempting to plate these directly I get poor adhesion of the nickel. Can you suggest a proper procedure for getting a good adherent coating of bright nickel on this type of product?

O. V.

Answer: In order to get an adherent deposit on this type of surface, the blued oxide film must first be completely removed. This can be done in several ways: pickling, electropolishing, or polishing and buffing. Both of the latter would leave the parts in an ideal condition for direct nickel plating from a bright nickel bath. However, a strike in a cyanide copper bath prior to nickel plating is preferable. All these operations assume that proper cleaning cycles are used before plating, of course.

Black Finish on Silver Brazed Steel Parts

Question: We want to produce a uniform black finish on our silver brazed steel parts. Treatment in the regular blackening bath does not color the brazing metal, making it very conspicuous. Can you tell us how to go about getting such a black finish all over the assemblies?

R. J. O.

Answer: The easiest way to overcome this problem would be to plate the assemblies with either brass or copper, then use one of the copper blackening baths available from a number of suppliers. Constant treatment of silver-brazed parts in your steel blackening bath will eventually contaminate it with sufficient copper as to render it inoperative, without special purification treatments. Names of suppliers of copper blackening baths are being sent to you.

Brightening Tin Plate on Cast Iron

Question: We have had occasion to machine and store our tinplated cast iron parts, during which time they have become dirty and have lost their luster. Can you give us the formula for a bright dip to restore the original bright plated surface to these parts?

J. G. N.

Answer: To the best of our knowledge, there is no simple chemical solution that will produce a bright surface on tin plate by immersion. The parts should first be thoroughly degreased and the surface dirt brushed off, then heated in a neutral oil bath to a temperature above the melting point of the tin (450°F) to melt and brighten the tin plating. The oil bath is necessary to prevent oxidation and loss of luster. Oils having sufficiently high flash points for this work are available from a number of firms supplying the heat treating trade.

Tinning by Immersion Treatments

Question: Can you give us any information on a process for tinning brass and copper parts by a non-electrolytic immersion process?

V. E. V.

Answer: Thin deposits of tin can be formed on copper and brass parts in the following baths:

1) Sodium Chloride 4 oz./gal.
Cream of Tartar 4 "

Place the cleaned parts in wire trays, with thin sheets of pure tin spaced throughout the batch. Immerse the parts in the above bath, and hold at 180-190°F for 3-4 hours.

2) Place scraps of pure zinc in a wire basket along with the cleaned brass parts. Place in the following bath, held at 175°F, for 2-4 hours:

Stannous Chloride 2 oz./gal.
Cream of Tartar 4 "

The April 1949 issue of Metal Finishing contained an interesting story of how immersion tinning is used on a commercial basis.

Gold Plating Electrical Contacts

Question: We have always silver plated our brass and bronze electrical

contacts, but recently we decided to switch to gold, as it will not tarnish like the silver does. Would a 1 minute barrel gold plate be sufficient? Would we have to silver or nickel plate the parts first? Any help you can give us will be appreciated.

C. W. B.

Answer: As long as the parts are not going to require any special gold color, and simply require tarnish protection, there is no reason why the gold cannot be deposited directly over the brass and bronze. An exact barrel cycle would depend on many factors, and we suggest that you standardize on a given barrel load, solution composition, solution temperature, and current, allowing sufficient time to adequately cover all the parts in the barrel.

Cast Iron Drains for Plating Room

Question: We are attempting to remodel an old building for use in our plating work, and notice that the drains are of cast iron. Will this be satisfactory for outlets from our liver of sulfur and sodium cyanide solutions? These will be the only materials drained off through these drains.

V. C.

Answer: The existing cast iron drains will be all right for these two materials, and should stand up for some time, but if you attempt to discard acid solutions through these pipes they will deteriorate rapidly. Silicon irons are the most suitable for this type of application, and should be installed if at all possible, preferably when any remodelling is being done. This will give you a drain system capable of handling all of the common plating room wastes.

Refinishing Holloware

Question: The article in the June issue of METAL FINISHING on refinishing of holloware was very interesting to us, but there was no mention made of the method required for getting off the black layer that forms under the plating on all Britannia metal and pewter articles. Can you tell us how this can be done without etching the metal too badly?

W. M. T.

Answer: The film that forms on silver plated Britannia and pewter articles is principally silver sulfide. This can be removed as follows:

1—Soak in alkali cleaner for 1-2 mins.
2—Rinse in hot water.
3—Immerse in hot cyanide solution (8 oz./gal.) at 120-130°F until all black disappears. This may take as long as 15 mins.
4—Scratch brush with soap bark water to clean and prepare the surface for subsequent operations.

Chromic Acid Control

Question: We have been using both an analytical method and the hydrometer method for controlling the chromic acid content of our chrome plating bath, and note that the two methods do not agree. Which is the correct method to use?

B. R. H.

Answer: The analytical method, when properly performed, is the most reliable method of chromic acid control. The hydrometer method is affected by any and all materials that may be dissolved in the bath, whether they are chromic acid or otherwise, and for this reason will give high results, especially in old plating baths that have accumulated impurities through drag-in or chemical solution.

Hardened Surface on Ball Burnished Parts

Question: Can you tell us whether or not ball burnishing and other tumbling operations could be the cause for hard surfaces on our brass castings?

W. M. N.

Answer: Under proper conditions there would be no perceptible increase in hardness of the surface of barrel finished parts. Ball burnished parts might show a superficial hard skin, but this would normally be only a thousandth or two in depth. The extra hardness often attributed to burnished parts is really due to the fact that the surface pinholes and pores have been smoothed over. The extreme surface hardness of brass castings would be more affected by the casting conditions than it would by barreling.

PROFESSIONAL DIRECTORY

HENRY LEVINE & SON, Inc.
Metal Finishing Consultants
Analysis—Plant design—
Process development
67-54 Burns Street, Forest Hills, N. Y.
Boulevard 8-8897

G. B. HOGABOOM JR. & CO.
Consulting Chemical Engineers
Metal Finishing — Electrodeposition — Solution analyses. AIR FORCE CERTIFICATION TESTS—Salt spray, thickness of deposits, adhesion.
44 East Kinney St. Newark 2, N. J.
MArket 3-0055

"ELECTROCHEMICAL TECHNOLOGY"
E. J. HINTERLEITNER AND ASSOCIATED ENGINEERS
669 Summit Ave., Westfield, New Jersey
Phone: Westfield 2-4766
Comprehensive Consulting Service for ALL Metal-Finishing Problems
Complete Systems and Installations prepared for ALL MODERN PROCESSES
FOR: SPECIAL PROCESSES SUCH AS: Chromeplating in bulk (INVENTOR)
FOR: Hard chromeplating—including INTERIORS of gun barrels, etc.
FOR: Rust Removal on production basis
FOR: Surface Conversions—prior to—AND:
FOR: Lacquering, Enameling, Baking, etc.
FULL INSTRUCTIONS PROVIDED
CONTINUED: NEXT MONTH

SCIENTIFIC CONTROL LABORATORIES
Finishing Consultants—Registered Engineers
Salt Spray—Thickness Testing—Analyses
PLANNING—RESEARCH—DEVELOPMENT
HAymarket 1-2260
600 BLUE ISLAND AVENUE CHICAGO 7, ILL.

JOSEPH B. KUSHNER, Ch.E.
Metal Finishing Consultant
Problems in Automatic Plating, Electroforming and Plastic Plating; Plating Plants Installed.
233 W. 26th St., New York 1, N. Y.

JOHN W. MAGLY
Consulting Chemical Engineer
ELECTROPLATING PROCESSES
DEVELOPMENT—ANALYSES
TROUBLESHOOTING PLANT PROCESSES
2731 Vine St. Cincinnati 19, Ohio
Avon 3977

PLATERS TECHNICAL SERVICE, INC.
ELECTROPLATING AND CHEMICAL ENGINEERS
A complete service for metal finishers including solution and deposit analyses, process development and plant design.
New York Laboratory
59 East 4th St. New York 3
ORchard 4-1778
Chicago Laboratory
509 S. Wabash Ave. Chicago 5
Harrison 7648

Engineering Data Sheet

Engineering Information Useful In Designating Metallic Surface Treatments

ZINC PLATING

A Comparison of Plating Thickness Specifications of Various Services, Societies, and Industrial Firms

AMERICAN SOCIETY FOR TESTING MATERIALS

Specification A164-40T

Plating thickness on significant surfaces—

Type GS	.001″ minimum
Type LS	.0005″ "
Type RS	.00015″ "

Notes—

Significant surfaces on any part must be mutually agreed upon by vendor and purchaser.
Microscopic method used for checking thickness.

NAVY DEPARTMENT

Specification 46-P-2

Plating thickness on significant surfaces—

Parts not externally threaded	.0005″ min.
Externally threaded parts	.0002″ "

Heavier coatings may be specified on contract.

Notes—

Drop test used for checking (Ammonium nitrate-nitric acid reagent).
Bend test around a mandrel of same thickness as sheet also a part of this specification.

CHRYSLER CORPORATION

Chrysler specifications for zinc are identical to their specs. for cadmium. See July 1949 Data Sheet for details.

PACKARD MOTOR CAR COMPANY

Specification 1407A-B-C

Plating thickness on significant surfaces—

.0005″ min. for exterior use.
.00015″ min. for interior use.
.00015″-.00035″ for spring temper parts.

Notes—

Spring tempered parts baked at 350-400°F for 1 hr. to relieve hydrogen embrittlement.
Pickling or cathodic cleaning of springs not permitted.

SOCIETY OF AUTOMOTIVE ENGINEERS

Specification AMS 2402B

Plating thickness on significant surfaces—

Non-threaded parts	.0005-.0007″
Threaded parts	.0001″ min. at root of thread .0002″ min. on non-threaded areas

Notes—

Significant surfaces are those touched by a .750″ dia. ball.
Magnetic test used for thickness.
.0005″ plating must withstand 200 hrs. Salt Spray Test.
.0002″ plating must withstand 150 hrs. Salt Spray Test.
.0001″ plating must withstand 100 hrs. Salt Spray Test.

AIR FORCE—NAVY DEPARTMENTS

Specification AN-P-32a

Plating thickness on significant surfaces—

Non-threaded parts	.0005″ min.
Threaded areas	.0002″ "

Notes—

Springs should be heated to 275°F for 4 hrs.
.0002″ plating must withstand 100 hrs. Salt Spray Test.
Drop test used for checking (chromic acid-sulfuric acid reagent).

FORD MOTOR COMPANY

Product Specification P-41

Plating thickness on significant surfaces—

Class A	.0005″ min.
Class B	.00035″ "
Class C	.00015″ "

Notes—

Class A plating to withstand 100 hrs. Salt Spray Test.
Class B plating to withstand 50 hrs. Salt Spray Test.
Class C plating to withstand 25 hrs. Salt Spray Test.
Spring temper parts baked at 400°F for 45 mins.
Case hardened parts baked at 350°F for 1 hr. minimum.
Drop test or magnetic test used for thickness.

GENERAL MOTORS CORPORATION

Specification 4252-M

Plating thickness on significant surfaces—

Code 50	.0005″ min.
Code 20	.0002″ "
Code 15	.00015″ "
Code 10	.0001″ "

Notes—

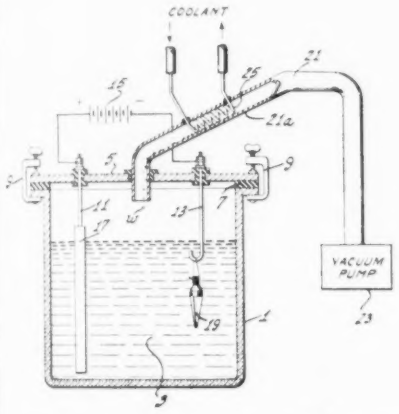
Drop test may be used for checking thickness (Chromic acid-Sulfuric acid reagent).
Parts harder than 302 Brinnell baked at 400°F for 4 hrs. or 300°F for 8 hrs.
.0005″ zinc plate to withstand 48 hrs. Salt Spray.
.00015″ zinc plate to withstand 24 hrs. Salt Spray.

PATENTS

Plating Under Vacuum

U. S. Patent 2,465,747. *Leopold Passel, assignor to Radio Corp. of America.*

In electroplating apparatus for electrodepositing metal, the combination of a fluid tight receptacle containing an aqueous electroplating solution, an anode therein and a cathode therein to which the work to be plated is connected, means including a vacuum pump and a duct having an inclined



portion connecting said pump to said receptacle for maintaining the interior of said receptacle at a pressure lower than atmospheric pressure whereby (*a*) to enhance removal from said work of any gas liberated from said electrolyte during the plating operation, and (*b*) incidentally to enhance evaporation of water from said electrolyte, and means within said duct for cooling said inclined portion of the duct for condensing the evaporated water in the duct and returning the condensed water flowing back through the inclined portion of the duct to said electrolyte whereby to maintain the quantity of water in said electrolyte substantially constant.

Plating Rhodium-Nickel Alloys

U. S. Patent 2,461,933. *Paul T. Smith & Joseph A. Smith.*

The method of alloy plating a metal article with an alloy having the characteristics of the metal of higher atomic weight therein, comprising, immersing said article in an aqueous solution containing a soluble metal salt of the group consisting of nickel and cobalt and a soluble rhodium salt in amounts varying from 3.55 to 13.72 grams of total dissolved metal per liter by weight of metal in proportions by weight of nickel or cobalt to rhodium varying from 8 to 1 to 33.3 to 1 and free inorganic acid, adjusting the pH value of said bath by the addition of free inorganic acid to a value not less than 1 and not in excess of around 1.7 and passing current through said bath with a cathode current density from about 40 to about 96 amperes per square foot and at a temperature from about 120° F. to about 150° F. to cause alloy plating of a metal alloy on said article with an alloy plate containing from 62-38 to 98.3—1.7% by weight of the respective metals.

An article having a tarnishable metal body, a wear resistant coating of tarnish resistant substantially white metal of at least one of the group consisting of nickel and cobalt over the body and an acid resistant, tarnish resistant, bright, hard, substantially white electrodeposited outer alloy coating consisting essentially of 95.4-98.3% by weight of metal of at least one of the group consisting, of nickel and cobalt and 4.6-1.7% by weight of rhodium having characteristics of the metal of higher atomic weight, namely rhodium, therein.

Removing Corrosion from Zinc and Its Alloys

U. S. Patent 2,465,987. *Daniel A. Gorman.*

The method of removing from zinc, zinc alloys and zinc coated materials the effects of oxidation thereof which comprises immersing the metal in a bath comprising per gallon of water 2 ozs. by weight of tartaric acid, 2 ozs. by weight of ammonium chloride, and 0.25 oz. by weight of mercuric chloride, while maintaining the bath at a temperature of about 150° F.

Electropolishing Tantalum

U. S. Patent 2,466,095. *John F. Gall and Henry C. Miller, assignors to Pennsylvania Salt Mfg. Co.*

The electropolishing of metallic tantalum by making it anodic in an electrolyte, containing 2%-7% by weight of hydrogen fluoride and 75%-98% by weight of sulfuric acid, the combined acid concentration being between 77% and 100%, the balance being substantially water, and passing current at an anodic current density of from 40 to 160 milliampers per square centimeter until the metal surface has developed a high, mirror-like polish.

Lead Plating

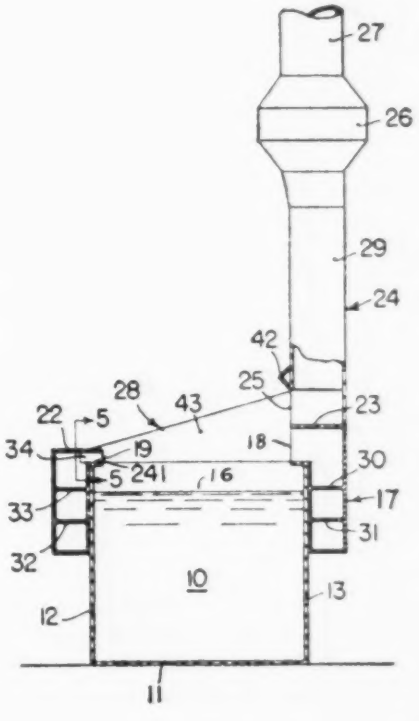
U. S. Patent 2,466,660. *Theron A. Loveland, assignor to Republic Steel Corp.*

An aqueous electrolyte for use in lead plating consisting essentially of about 200 grams per liter of lead acetate, about 100 grams per liter of sodium acetate, about 15 grams per liter of acetic acid, about 4 grams per liter of bone glue, about 5 grams per liter of sucrose, and about 5 grams per liter of 2-naphthol-6-sulfonic acid.

Fume Exhaust System

U. S. Patent 2,467,505. *Philip A. Sidell, assignor to American Machine and Metals, Inc.*

In an exhaust system for the removal of odors, fumes or vapors arising from an open tank, two ducts having each an inlet opening and an outlet opening, a power driven ventilator in each of said ducts, the inlet openings of said two ducts extending over substantially the whole length of said tank and being arranged one closely above the other at the rear end of said tank near the top of the latter, the outlet opening of the duct containing the lower of said inlet openings extending over substantially the whole length of said tank near the top of the front



end thereof, the duct containing the upper of said inlet openings emptying into an exhaust, and partitioning means in at least one of said two ducts for dividing said duct or ducts lengthwise into a plurality of channels.

Chemical Coating for Aluminum

U. S. Patent 2,466,971. *O. L. Shawcross, assignor to Aluminum Co. of America.*

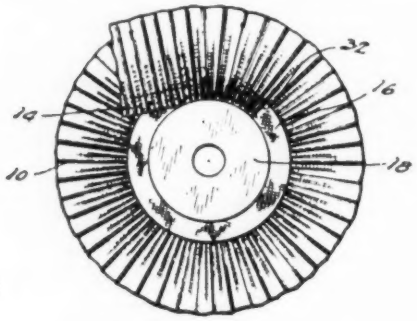
The method of forming an adherent, tough, chemically produced oxide coating upon an aluminum surface by treating said surface with an aqueous solution containing, as active coating former, about 0.5 to about 6 per cent by weight of alkali metal carbonate, said solution also containing about 0.5 to about 5 per cent of at least one substance selected from the group consisting of casein, albumen, zein and gelatin.

The method of claim 1 characterized by the fact that said aqueous solution also contains, as active coating former, about 0.05 to about 0.5 per cent by weight of alkali metal chromate.

Buffing Wheel

U. S. Patent 2,468,686. *Nathan E. Sax, assignor to American Buff Co.*

A buffing wheel comprising a strip of textile material wound in the form



of a spiral, a fabric sheet having a slit positioned between two convolutions of said textile material, said textile material extending through said slit, and means for securing said textile material to said fabric sheet.

Bright Nickel Plating

U. S. Patent 2,466,677. *Henry Brown assignor to Udylite Corp.*

A bath for electrodepositing fine-grained, lustrous nickel comprising essentially an aqueous acid solution of a material selected from the group consisting of nickel chloride, nickel sulfate, a mixture of nickel sulfate and nickel chloride, nickel sulfamate, a mixture of nickel sulfamate and nickel chloride, nickel fluoborate, a mixture of nickel fluoborate and nickel chloride, a mixture of nickel fluoborate and nickel sulfate, a mixture of nickel sulfate, nickel chloride and nickel fluoborate and a mixture of nickel fluoborate and nickel sulfamate, said solution also having dissolved therein an unsaturated organic compound selected from the group consisting of alpha unsaturated aliphatic sulfonamides and sulfonimides and beta unsaturated aliphatic sulfonamides and sulfonimides in a concentration sufficient to increase the luster and brightness of the nickel deposit and falling within a range from .05 gram per liter to saturation.

Acid Inhibitors

U. S. Patent 2,467,164. *Harold R. Slagh, assignor to Dow Chemical Co.*

A composition comprising an aqueous hydrochloric acid solution and a relatively small proportion of a liquid product, containing between 15 and 35 per cent by weight of chemically combined sulphur, which liquid product is formed by direct reaction of sulphur with turpentine oil.

The process for reducing the corrosive action of an aqueous non-oxidizing mineral acid solution on a ferrous metal, which comprises incorporating with the aqueous non-oxidizing mineral acid solution a liquid product selected from the class consisting of liquid sulfurized hydrocarbons formed by a direct reaction of sulfur with olefinic hydrocarbons having at least six carbon atoms in the molecule, which sulphurized hydrocarbons contain between about 15 and about 35 per cent by weight of chemically combined sulphur, and liquid products resulting from incomplete oxidation of said sulphurized hydrocarbons, which incompletely oxidized liquid products contain between about 3 and about 10 per cent by weight of chemically combined oxygen.

Composite Plated Coating

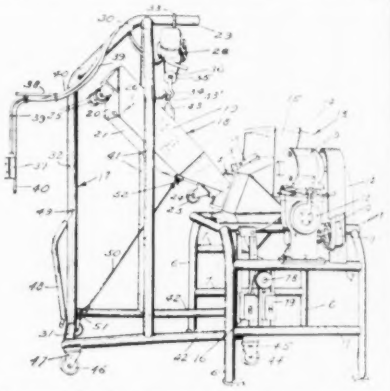
U. S. Patent 2,468,825. *Geo. W. Jernstedt, assignor to Westinghouse Electric Corp.*

An article of manufacture comprising, in combination, an electrically conducting base member, a thin electrodeposited coating of a thickness of from 0.1 to 0.5 mil of a bright silvery ternary alloy composed of from 50% to 75% copper, 20% to 35% tin and from 8% to 15% zinc applied to the base member, and a thin coating less than 0.1 mil in thickness of chromium electrodeposited over the tenary alloy coating.

Deburring and Polishing Barrel

U. S. Patent 2,470,340. *E. E. Cook and H. J. Sadler, assignors to Almco, Inc.*

A hoisting mechanism comprising, a horizontally-disposed forwardly-opening U-shaped hoist frame member, a vertically-disposed inverted U-



shaped hoist frame member connected at its base to the opposite sides of the horizontal hoist frame member intermediate the ends thereof, a hoist-supporting element secured to the upper portion of said vertical hoist frame member and projecting forwardly intermediate the sides thereof, a hoist detachably secured to and depending from said hoist-supporting element, hook means carried by said hoist, a portable hoist pan adapted to pass between the side members of said horizontally-disposed U-shaped hoist frame member, a centrally-located transverse hoisting bar on said hoisting pan, a ball on said hoisting bar adapted to be engaged by the hook means carried by the hoist, and a cable secured at one end to the front end of the hoist pan and at its other end to the closed end of the horizontally-disposed hoist frame member, said cable being of a length to tilt the hoist pan forwardly to dump its contents when said hoist pan has been elevated to a predetermined position.

Electrocleaner

U. S. Patent 2,468,006. *Hugh G. Webster, assignor to J. H. Shoemaker.*

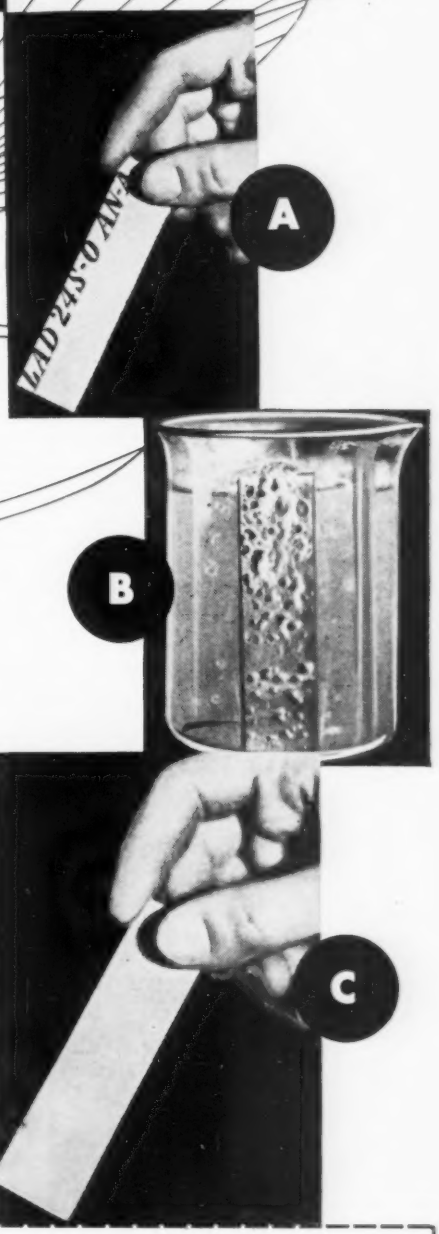
A composition for electrolytic cleaning of metal consisting essentially of a major proportion of caustic alkali and minor proportions of sodium chloride and sodium aluminate, said sodium aluminate being present in proportions of .5 to 5% by weight.

Remove Marking Inks and Soil

FROM ALUMINUM

EASY AS A B C!

DIVERSEY No. 36



removes inks swiftly, completely . . .
leaves no white film . . . non-corrosive!

Never before have aluminum working plants had at their disposal such a unique and efficient aluminum cleaner . . . one which provides an absolutely clean surface in so short a time!

Diversey No. 36 aluminum cleaner does not cause gassing, corrosion and white film . . . even in hard water! Diversey No. 36 always assures a 100% clean surface in surprisingly less time *. . . in recent field tests, inks which could not be removed with ordinary aluminum cleaners in 10 to 15 minutes were completely removed in 4 to 5 minutes with Diversey No. 36!* Diversey No. 36 possesses amazingly high water softening, wetting, emulsifying and free rinsing properties! No. 36 is easy, economical, extra safe to use! Investigate today . . . mail the coupon now!

THE DIVERSEY CORPORATION
Metal Industry Department
53 W. JACKSON BLVD., CHICAGO 4, ILLINOIS

MAIL THIS COUPON TODAY!

THE DIVERSEY CORPORATION
Metal Industry Department
53 W. JACKSON BLVD., CHICAGO 4, ILL.

DMI

Gentlemen:
Please send me complete information on Diversey No. 36.

Name_____ Title_____

Company_____

Address_____

City_____ State_____

Recent Developments

New Methods, Materials and Equipment for the Metal Finishing Industries

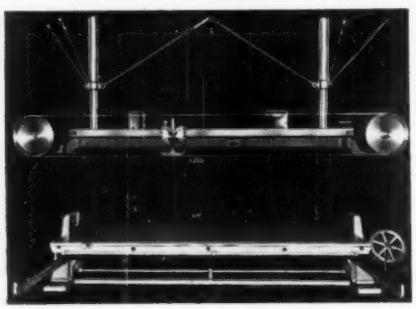
Table Type Belt Polisher for Large Flat Surfaces

Curtis Machine Co., Dept. MF, 1300 *E. Second St., Jamestown, N. Y.*

This firm announces a new abrasive belt polishing and grinding machine that has many and varied applications in the metal working field. This versatile machine comes in two parts, the abrasive belt unit and a table unit. It can be purchased with or without the table unit. The abrasive belt unit is suspended from the ceiling and is adjustable vertically by a motorized unit on two telescoping tubes. This arrangement permits the lowering and raising of the machine to accommodate finished metal cases of varying heights. The adjustment down to the work is made very quickly by a push button. In some instances these units have been suspended over an assembly line for grinding or polishing large surfaces on finished cases.

This unit can also be lowered down to the table in order to polish or grind flat sheets. It is particularly adaptable to custom metal working shops where many different forms and shapes of work are produced.

It is widely used by manufacturers of show case equipment, producers of store fronts, and metal cabinet manufacturers, according to the firm.



It is available in a standard 6′, 8′ or 10′ length and in the single abrasive belt or double belt style. The double belt machine will permit the use of a coarse abrasive for stock removal and and finer abrasive for finish polishing. The Curtis traveling head permits sanding of large areas with speed and a minimum of operator fatigue. The finest types of finishes can be obtained on this unit, it is claimed.

Reverse-Current Cleaner for Zinc Die-Castings

Pennsylvania Salt Mfg. Co., Dept. MF, Special Chemicals Div., 1000 *Widener Building, Phila. 7, Pa.*

A new, improved cleaner for reverse-current cleaning of zinc-base die-castings prior to electroplating was announced recently by this firm.

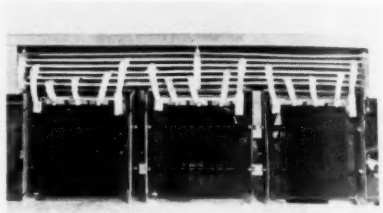
The new product will be marketed by Pennsalt's Special Chemicals Division under the name of Pennsalt Cleaner Z154. It is composed of carefully balanced, anhydrous alkaline ingredients plus a combination of synergistic surface active agents. Usually, according to *Joseph J. Duffy, Jr.,* divisional manager of sales, Z-54 is employed after a proper pre-cleaning operation such as spray washing, emulsion cleaning, or vapor degreasing.

Recommended concentration for Pennsalt Cleaner Z-54 is five ounces to the gallon. Improved cleaning is said to be achieved because solution temperatures may average between 180 and 190 degrees Fahrenheit. Substantial reduction in blistering has been reported by initial users of the product, according to the firm.

High Current Dual Rectifier Elements

International Rectifier Corp., Dept. MF, 6809 *South Victoria Ave., Los Angeles* 43, *Calif.*

One of the largest known dual selenium rectifier elements measuring 7¼″ x 12¾″ has been developed by the above firm. Each dual element actually consists of two of the company's largest size 6¼″ x 7¼″ plates strapped in parallel and rated in a three phase bridge circuit at 34 amperes for continuous duty self-cooling; 85 amperes for continuous duty fan-cooling and 340 amperes for highly intermittent duty. These dual elements are assembled in the company's three phase bridge heavy duty 10 K.W. rectifier stack rated at 1500 amperes for such applications as magnetic inspection, etc. The stacks are designed on the basis of 16 K.W. per cubic foot and are provided with an interlocked assembly to prevent lug misalignment and plate rotation. They are covered with a multiple dipped black coating for improved heat radiation and protection against high humidity, excessive moisture and other adverse atmospheric conditions. Operating efficiencies of 85% can be obtained and when aluminum plates are used the weight per dual element minus the hardware is 9 ounces. Each 1500 ampere stack is 7¼″ wide by 12″ long by 14½″ high.



These dual rectifier assemblies are especially applicable for high current, intermittent duty, medium voltage (550 volts and below) applications.

Further information and literature concerning these selenium rectifiers is available upon request.

New Buffing Composition

Beacon Supply Co., Dept. MF, 110 *Marginal St., Chelsea, Mass.*

The above firm announces the development of a revolutionary new buffing composition called Violet Ray compound by their chief chemical and production engineer, *Mr. Vincent Morris.* This Violet Ray compound is claimed to give faster cut, higher color, easier cleaning than any conventional compound previously marketed. The homogenized binder contains no animal, mineral or marine fats, greases or pitches. This violet colored binder, combined with the proper abrasive for tripolies, lime finishes, stainless steel bars, and jewelers' rouges, is claimed to adhere to and penetrate the buffing wheel itself to insure more buffed pieces and less rejects. While it contains no added wetting or emulsifying agents, it cleans easily in a mild alkali solution, according to the firm. The

Ray Compounds Division of Beacon Supply Co. under the direction of Mr. Morris is in full production of this line of Violet Ray compounds.

Still and Degreaser

Phillips Mfg. Co., Dept. MF, 3483 W. Touhy Ave., Chicago, Ill.

The newest addition to the Phillips line of degreasers and stills is their Model ST-1. This is a combination 5 gallon per hour still and is just as efficient as a small degreasing machine. It is electrically heated and is comprised of two compartments. The first compartment is heated with strip heaters and boils the solvent, the vapors flowing over to the second compartment where they are condensed by a small cooling coil. Its distillation rate of 5 gallons per hour will vary slightly depending on whether trichlorethylene or perchlorethylene is used. There is

a thermostat in the boiling sump to prevent overheating in case of excessive contamination.

It can be used as a degreaser by immersing the parts in the agitated boiling sump and then holding them in the vapor area to rinse and dry. It is an excellent auxiliary to larger degreasing equipment and can be used with either trichlorethylene or perchlorethylene. It is 36 inches long, 17 inches wide and 40 inches high overall. The inside dimensions of each compartment are 14 inches x 15 inches with 11 inches of working depth.

Filter Aid for Cyanide Copper Baths

Brown Co., Dept. MF, 500 Fifth Ave., New York 18, N. Y.

A filter aid approved for use with the du Pont High-Speed copper plating solution is available under the trade name Solka-Floc from this firm.

To comply with du Pont recom-

THERE'S no need for paying the cost of excessive rejects when the trouble lies in poor cleaning of the steel surface before you begin your plating operation.

DOUBLE ELECTROCLEANING WITH MAGNUS CLEANERS IS THE ANSWER

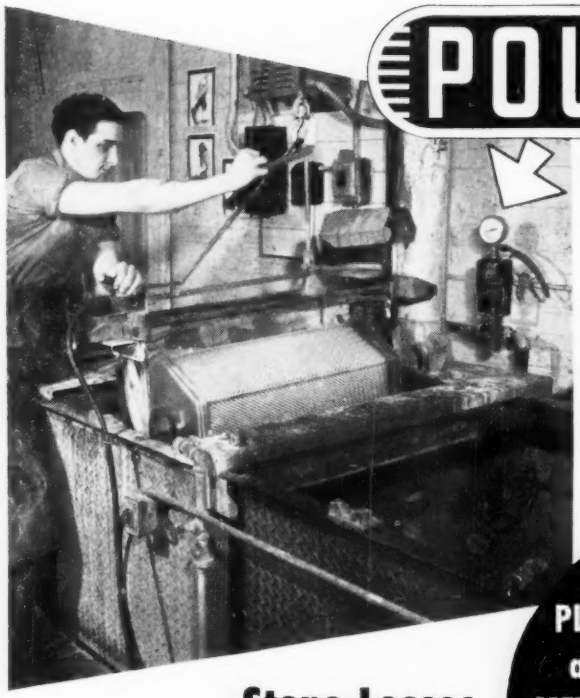
First, you clean cathodically for 1 to 2 minutes in Magnus 94XX solution. This special alkaline cleaner for steel (and brass or copper) parts is provided with greatly improved wetting action by the use of a synthetic surface-active ingredient of Magnus' own manufacture. 94XX has the added advantage of giving ample current carrying capacity to provide the densities you want for effective cathodic cleaning. (If you want longer lasting solutions, preclean the parts before electrocleaning in Magnusol.)

Next, clean the work anodically for 1 to 3 minutes in Magnus 61XX. This strongly alkaline cleaner is also provided with the same superior wetting action as 94XX.

When the work is rinsed after anodic cleaning, the usual dilute acid dip is used, the work is again rinsed and is then ready to be plated. It is clean—chemically clean—and should go through any plating operation, automatic or manual, with complete elimination of any rejects caused by ineffective cleaning.

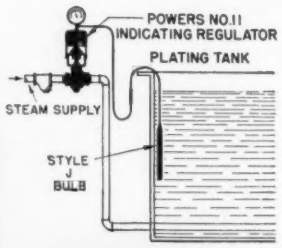
There are special Magnus materials for electrocleaning of die castings and other soft metals, as well as combinations of steel and soft metals. Let us know what you plate and we'll recommend a dependable procedure.

MAGNUS CHEMICAL COMPANY • 11 South Ave., Garwood, N. J.
IN CANADA—MAGNUS CHEMICALS, LTD., 4040 Rue Masson, Montreal 36, Que.
Service representatives in principal cities



POWERS

TEMPERATURE CONTROL



In PLATING, CLEANING and RINSE TANKS METAL PARTS WASHERS DEGREASERS ANODIZING, BONDERIZING AND PICKLING TANKS

Stops Losses Caused by OVER-Heating

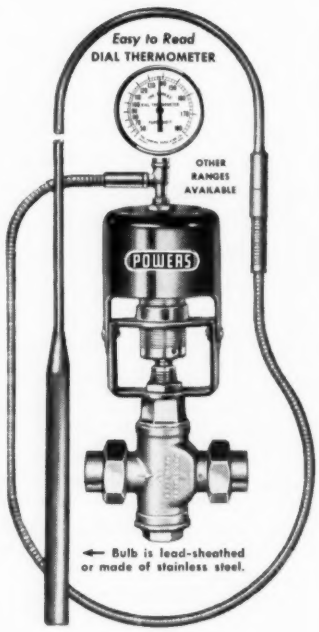
Stop human errors, mechanize temperature control of plating operations with POWERS No. 11 INDICATING REGULATORS. They maintain a constant temperature, are self-operating and easy to install.

Easy to Read Dial Thermometer indicates temperature in tank. Thermostatic bulb is lead sheathed or made of stainless steel. Powers regulators are gradual acting and ruggedly built to give the dependable control required for good plating.

Will Help You Get a Better Product at Lower Cost Better temperature control of plating solutions will help reduce rough plating, buffing time, insure plating within the bright range and reduce decomposition of solutions. Powers regulators pay back their cost many times a year. They are—

•

SIMPLE • ECONOMICAL • DEPENDABLE



Phone or write our nearest office for specifications and prices

CHICAGO 14, ILL. 2779 Greenview Ave. Phone BUckingham 1-7100
NEW YORK 17, N. Y. 231 East 46th St. Phone ELdorado 5-2050
LOS ANGELES 5, CAL. 1808 West Eighth St. Phone Drexel 2394
TORONTO, ONT. 195 Spadina Ave. Phone Adelaide 6257 PL2

THE POWERS REGULATOR CO.
OFFICES IN 50 CITIES • SEE YOUR PHONE BOOK
Over 55 Years of Temperature and Humidity Control

mendations, this aid is pre-coated from aqueous slurry and then washed in place in the filter by circulation of hot water for about one hour prior to contact with the plating solution.

Further details on the use of Solka-Floc with copper, silver, nickel, tin, chromium, etc., plating solutions may be obtained from the Brown Company Technical Service Department, or from most filter equipment manufacturers.

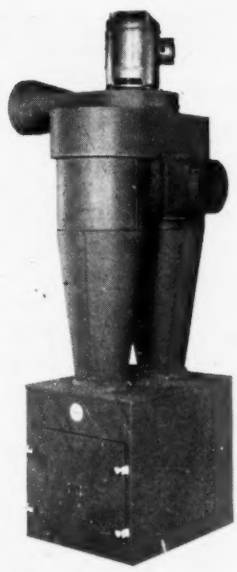
Twin Cyclone Dust Separator

Torit Manufacturing Co., Dept. MF, St. Paul 2, Minnesota.

This new Torit unit incorporates two cyclone separators of the same size used in the Torit Nos. 18-FM and 19-FM Models. As illustrated, the cyclones are mounted on a common bottom reservoir, which has a 20″ wide, 28½″ long, 15½″ high pull-out drawer—capacity about 4½ cubic feet.

Equipped with a 5 H.P., 3450 RPM end-mounted motor (motor starter included), 8″ inlet and 10″ exhaust outlet, it develops 2100 c.f.m. velocity 6000 ft. per min., static pressure, 3″.

The overall height of the No. 219 Unit is 90″, overall width 35″, overall depth 29½″. It requires 24″ x 30″ floor space—height from floor to inlet



is 59½″ and height to top of collector, exclusive of motor, is 72″.

This model is available only for outdoor exhaust (not available, in other words, for indoor recirculation). It develops approximately double the air volume (c.f.m.) of any previous Torit cyclone type dust separator.

Illuminated Magnifier

E. W. Pike & Co., Dept. MF, Elizabeth, N. J.

A new and improved Flash-O-Lens Illuminated Magnifier, with a knurled pinion for adjusting the 20 or 40 power tube easily and accurately to

the user's exact visual needs, has just been announced by this firm.

A rubber roller on the shaft of the knurled adjusting pinion, which is mounted on the housing of the instrument, bears against the vertical tube, housing the lenses. By turning the knurled pinion, the tube and lenses can be raised or lowered to bring the object being examined into perfact, sharp focus. This new Flash-O-Lens model is widely used for examining chemicals, foods, dairy products, negatives, type, textiles, metals, finishes and any product or raw material which requires accurate inspection through illuminated magnification. Available with 20 or 40 power lenses, in either the electric plug-in model (120 volt, AC or DC) or in the battery model.

Hand Cleanser

Turco Products, Inc., Dept. MF, 6135 South Central Ave., Los Angeles 1, Calif.

This firm announces a free trial offer of five pounds of Handisan, the specially-engineered granular hand cleanser. Already widely used in industry, Handisan is cleanser, detergent and scrubber all in one. As they dissolve, special detergent granules scrub and loosen imbedded grime, ink and grease. These granules are 100% soluble. There are no mineral or vegetable abrasives to clog plumbing, it is claimed, and no residue is left in sinks, no bacteria-breeding fillers to catch in open cuts on hands.

Handisan has emollient properties and is much less alkaline than most

No Other Buffing COMPOUND Can Make this Claim . . . .

Greater Cut!

Less Waste!

J. J. SIEFEN Spray Compounds have NO equal . . . nor a close substitute! Years of experience in the field have proven this to scores of satisfied users. SIEFEN Compounds definitely give a greater cut, yet are the most economical on the market to use! Regardless of your type of Buffing operation there's a SIEFEN Compound that will do your work *quicker, better* and will *reduce* your operating cost!

Greater Profits from Greater Efficiency!

Write us for full information on the SIEFEN SYSTEM—complete Spray Equipment for all Buffing and Polishing work... More production and profits!

Spray Compounds are Fast Replacing Bar Compounds!

Industry surveys have proven that 50% to 75% *less* spray compound is needed for the same work as bar compound! It eliminates fire hazard and excessive Buff wear. Modern plants are now using Spray Compounds—most use SIEFEN COMPOUNDS!

THE Siefen System
SPRAY EQUIPMENT
SPRAY COMPOUNDS
SPRAY SERVICE

J. J. SIEFEN CO.

5643 Lauderdale
Detroit 9, Mich.

BETTER-THAN-USUAL SERVICE

with

HENDERSON

WOOD TUMBLING BARRELS

- BEST GRADE MAPLE or other woods to specification
- GREATER THICKNESS for longer life
- QUALITY FABRICATION by skilled and experienced workmen

A SIZE AND SHAPE FOR EVERY PURPOSE

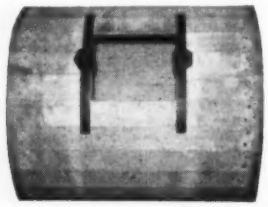
8 to 14 sided barrels — 14″ to 38″ in diameter
Round barrels — all sizes
Horizontal barrels — various shapes and sizes

SPECIAL BARRELS

Where finishing specifications call for a different type barrel, Henderson Bros. is prepared to construct special equipment for practically any purpose.
ALSO barrels in steel, stainless steel, brass, Monel Metal and other alloys.

Large sided wood barrel

Small sided wood barrel



Horizontal wood barrel

Round wood barrel

SINCE 1880 DESIGNERS and BUILDERS of Tumbling Equipment

THE HENDERSON BROS. COMPANY
135 S. LEONARD ST., WATERBURY, CONN.

ordinary "toilet" soaps; thus, even women office workers report Handisan is gentle to hands, according to the firm.

Turco will deliver the free Handisan sample to companies with at least twenty-five employees. Request should be made on company letter-head.

Synthetic Detergents

Antara Products, General Aniline & Film Corp., Dept. MF, 444 Madison Avenue, New York 22, N. Y.

Two new, non-ionic synthetic detergents—Antarox A-400 and Antarox A-480—introduced recently by this firm are displaying versatility at low cost in many different detergent applications, it is claimed.

The fact that these two new detergents of the aromatic polyethylene glycol ether type are practically odorless, says the manufacturer, makes them particularly valuable for the specialized demands made upon detergents today.

Antarox A-400 and A-480, because of their ether structure, are extremely stable in the presence of acids, alkalis and electrolytes, it is claimed. Because they do not ionize, they will not form insoluble compounds in hard water. They do not easily decompose or separate, according to the firm.

The new Antaroxes are foamers, making possible the formulation of products with consumer appeal. Their physical and chemical properties will not change over long periods of storage. They also are capable of withstanding wide variations in temperature, it is claimed.

Samples of Antarox A-400 and A-480, as well as complete technical information on their characteristics and applications, are available, the company says.

Heating Tank for Strippable Coatings

The H. McNaughton Co., Dept. MF, 201 Parsons St., Kalamazoo, Mich.

A new dip tank or melting pot known as "Electrodip," has been announced by this firm. It is thermostatically controlled, thoroughly insulated, fast heating and has an aluminum casting dip-compartment designed for maximum usefulness. It is used for dipping ethylcellulose and other removeable plastic coatings on

parts, tools and dies. As an oil bath it is used to transfer heat at accurately controlled temperature to irregular shaped devices and containers.

Heat is uniformly but gently transferred through thick aluminum walls to heat or melt, without charring, viscous compounds, waxes, greases, etc., it is claimed.

Large top opening and sloping walls with smooth rounded corners permit all parts of interior and bottom to be easily and comfortably reached for dipping operations or cleaning out.

Any temperature set on the calibrated dial is held within 1°F., it is claimed. Casting has large ledge to catch overflow and also makes it spill over proof. Pilot light flashes on and off when up to set temperature.

Highest quality closed type heating elements of 1000 watts and thermostat range 60 to 250 degrees F. or 200 to 500 degrees F. are installed for either 115 or 230 volts as specified.

Overall size 12″ x 12″ x 10″ high. Thick walled aluminum casting dip compartment tapered from 7″ x 7″ at top to 5″ x 5″ at bottom by 6″ deep. Shipping weight 37 lbs.

New Packaging for Acid-Proof Cement

The Electro-Chemical Supply and Engineering Co., Dept. MF, Paoli, Penna.

This firm announces an important change in the manner of packing and shipping Brimsto, the plasticized sulphur-base acid-proof cement.

Brimsto was formerly shipped in five or ten pound ingots, packed in fibre cartons, weighing 50 pounds net. It is now put up as small wedge-shaped wafers and packed 100 pounds to a bag.

The purpose of this new method of packing is to make handling easier (no breaking or chipping of ingots) and melting faster. Like the former ingots, it will not be affected by water and it is just as clean to handle.

Brimsto is applied by melting and pouring and is claimed to be proof against most strong inorganic acids. It is plasticized with Thiokol, synthetic rubber, to provide good thermal and mechanical shock resistance.

Sandblast Helmet

The W. W. Sly Mfg. Co., Dept. MF, 4700 Train Ave., Cleveland 2, O.

The above firm announces their new

helmet for the protection of sandblast operators against the inhalation of dust as well as for protection against rebounding abrasive.

The particular features of this helmet are its light weight for comparative comfort for the operator, its wide range of vision and freedom of head movement. All metal parts are of aluminum. The one piece hood is made of the best grade of rubber. This Sly "Purair" helmet carries the approval of the U. S. Bureau of Mines for air supplied respirators.

TODAY'S BEST BUY for Setting Up POLISHING WHEELS AND BELTS

GRIPMASTER PATENTED POLISHING WHEEL CEMENT

LEADING PLANTS REPORT: GRIPMASTER BOOSTS POLISHERS' PRODUCTION AN AVERAGE OF 47% MORE PIECES PER HEAD!

Now! **Longer Wheel Head Life!** Thanks to Gripmaster's special high-heat resisting ingredient!

Now! **Fewer Stops for Wheel Changes!** Gripmaster *locks in* grains of emery "vise tight!"

Now! **Inventories Simplified!** One grade grips *all* grains—300 to 20. No special sizer needed!

Now! **Better Finishes!** Greater flexibility gives more and finer "breaks" when wheel is "cracked!"

Now! **Goodbye to S. O.!** There's no Stockyards Odor in Gripmaster. It's clean, odor-free!

"First Choice of the World's Best Finishers"

YOURS FOR THE ASKING

GRIPMASTER DIVISION
NELSON CHEMICALS CORPORATION
12345 Schaefer Hwy, Detroit 27, Mich., U.S.A.

IN CANADA:
H. C. Nelson Chemicals, Ltd.
Windsor, Ontario

☐ Send us a generous FREE SAMPLE of Gripmaster.
☐ Send us data on how to boost polishing production.
☐ Have a representative call to demonstrate.

MF849

COMPANY_____
ATTENTION_____
ADDRESS_____
CITY_____ STATE_____

Steel Shot for Blasting

American Wheelabrator & Equipfent Corp., Dept. MF, 555 Byrkit St., Mishawaka, Indiana.

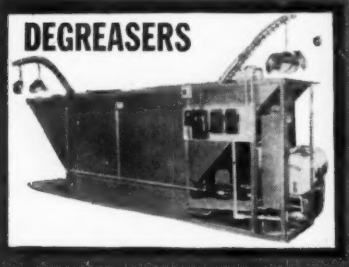
This firm has announced the development of Tru-Steel shot for use in all types of blast cleaning equipment. This new material is steel that has received a full heat treatment and exhibits that combination of hardness and toughness generally associated with steel.

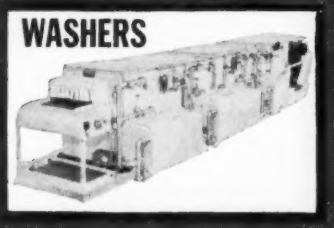
For the past six months, carefully controlled tests have been conducted in selected metal working plants throughout the country to determine how this new shot would perform under actual operating conditions. The results of these field tests verified earlier laboratory data and indicate the following advantages for Tru-Steel over earlier chilled iron abrasive, according to this firm:

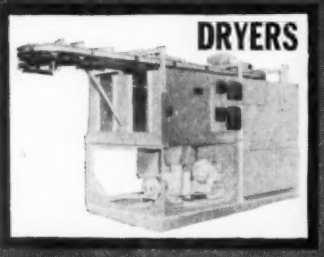
1. The useful life of the shot is much longer than that of chilled iron—there is less to buy, store and transport.
2. It wears down and does not break down—there is no possibility of fragments imbedding in soft work.
3. Greatly reduced wear on the blast cleaning equipment—fewer repair parts and less maintenance time are required.
4. It cleans at least as fast as chilled iron.
5. Lower cost per ton.

Tru-Steel Shot is now available for

Is METAL PARTS CLEANING a bottleneck in your plant?







A complete line of OPTIMUS Equipment is available in standard and special sizes to meet every metal parts cleaning problem and allied processing applications.

OPTIMUS VAPOR DEGREASERS are available in all various types and stages, straight vapor, vapor-spray, liquid-vapor and combinations of these. All sizes from simple batch type degreasers to custom built monorail or cross rod conveyor models.

OPTIMUS METAL PARTS WASHERS — single or multiple stage — screw or conveyor, mesh belt or monorail types. Can be applied to a wide range of operations as well as the handling of rust preventatives and other coatings.

OPTIMUS DRYERS embody a specially designed system of directional air jets which assure spotless drying after plating or polishing and before subsequent painting, plating or lacquering.

Submit your metal parts cleaning problem to our engineering staff. SEND FOR complete catalog of OPTIMUS Equipment.

Distributors of
"Midsolv"
A Perchlorethylene Degreaser Solvent
"Triclene D"
A Trichlorethylene Degreaser Solvent

SEND FOR
COMPLETE CATALOG AND
ADDITIONAL INFORMATION

OPTIMUS EQUIPMENT COMPANY
11 Water Street **Matawan, N. J.**
Offices in principal cities

OPTIMUS EQUIPMENT
FOR CLEANING · RINSING · DEGREASING · PICKLING AND DRYING OF METAL PARTS

immediate delivery in all sizes. A brochure describing the material in detail, test data and samples will be sent upon request.

Stable Graphite Film

Electrofilm Corp., Dept. MF, 7116 Laurel Canyon Blvd., N. Hollywood, Calif.

A successful means of applying a stable graphite film to practically any surface has been developed after 10 years of research by the above firm.

The new stable graphite film, as applied by the Electrofilm process, is extremely thin (0.00015 to 0.0005 in.) but has excellent resistance to abrasion and exceptional bearing strength, it is claimed. The adhesion to the intended

surface is high, and on metal and most other surfaces sufficient diffusion of the graphite into the surface is obtained to insure presence of a graphite surface even when the external coating is apparently removed, according to the firm. (See photo.)

The Electrofilm graphite process is applied by spray or dip, following normal surface preparation, and has been successfully used on metal, plastics, rubber and ceramics.

Electrofilm is stable, and provides the intended surface characteristics over temperatures ranging from –120° F. up and some variations have been tested satisfactorily to 2000°F. The graphite film is unaffected by exposure to solvents and weather, it is claimed.

Cost of applying the new Electrofilm graphite is low, and the process is licensed to manufacturers or can be applied by the Electrofilm Corp.

Vertical Drum Lifter

Palmer-Shile Company, Dept. MF, 16035 Fullerton Ave., Detroit 27, Mich.

Lifters for handling open and closed steel drums in the vertical position, by

crane or hoist, are now being manufactured by this firm, designers and manufacturers of materials handling equipment.

The new lifters are of all-steel construction with a heavily welded chain. The manufacturers point out that the vertical drum lifter was developed to handle open and closed drums vertically.

Synthetic Agent for Degreasing Metal

Bee Chemical Co., Dept. MF, 13799 S. Ave. O, Chicago 33, Ill.

A new emulsion degreasing agent has been announced by this firm. The new product, called Mulsolv, was withheld from the market until six months of commercial use had demonstrated

its performance, according to the firm.

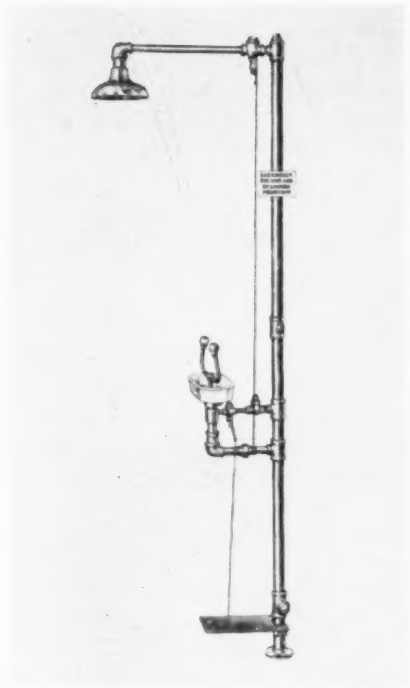
Mulsolv is intended for use in standard cleaning equipment for removing grease from metal parts prior to assembly or preliminary to preparation for shipment. It is non-toxic, requiring no protective arrangements to guard against dangerous fumes. It is also non-irritating to skin or nasal passages, it is claimed.

The makers say that Mulsolv leaves no scum, and results in negligible corrosion of the cleaned parts. They also claim minimum cost for their product in terms of pieces or areas cleaned. Mulsolv is sold in 50 gallon drums, and is mixed with 300 parts of water to make the degreasing solution recommended for general use.

Eye-Washing Fountain

Haws Drinking Faucet Co., Dept. MF, Fourth and Page Streets, Berkeley 10, Calif.

Much of the more dangerous aspects of workmen accidentally getting chemicals and other foreign matter into their eyes can quickly and easily be avoided with a new eye wash fountain and a specially designed shower just developed. Made in two styles, either



of which may be easily installed anywhere, great promise is held for better safety records in chemical and other industrial plants where this equipment is installed.

The one model, a fountain with two specially designed angle stream heads, directs a double stream of clean water into the eyes at a simple twist of the control valve. This immediately dilutes and washes away the foreign matter. The other model combines the fountain with a high-volume shower which delivers a sudden drenching bath that dilutes and washes away the chemicals before they can penetrate the clothing. In this model the fountain is operated by means of a foot treadle while a metal cord is pulled to operate the shower.

Developed in cooperation with safety engineers of a large, well known chemical plant, these facilities afford a most effective guard against permanent injuries caused by accidents of this type. The eye wash fountain is carefully designed to instantly put a maximum of water directly into the eyes without danger of further injury. This is accomplished by a pre-determined setting of a highly sensitive, fully automatic regulator which controls both the pressure and the volume of the water.

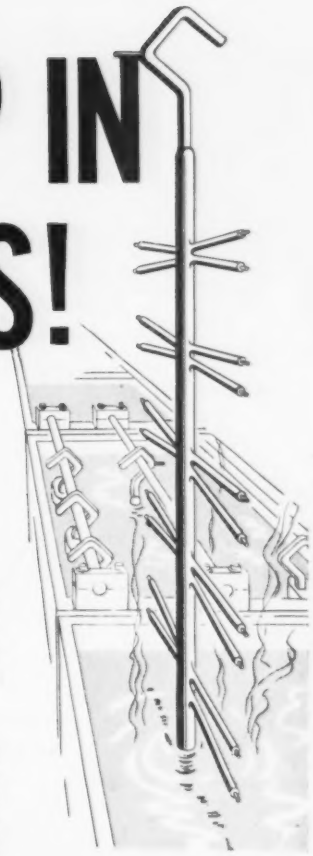
These new safety devices are being marketed nationally with immediate availability.

Improved Dust Collector Features Increased Suction

Aget-Detroit Co., Dept. MF, Main & Washington Sts., Ann Arbor, Mich.

Recent improvements in model 420 Dustkop dust collector to permit its

STANDS UP IN ALL CYCLES!



Outstanding rack protection achieved by plastisol Unichrome COATING 218X

No matter what you need in rack protective qualities, Coating 218X has it. Resistance to vapor degreasing? Coating 218X has that! Ability to stand up in hot cyanides or caustics? In chromium plating? Again 218X is the answer. And if it can withstand *those* plating operations, it will take them *all*.

In test runs at a well known plating plant, for example, Coating 218X was put through a cycle including soak cleaners, anodic alkaline cleaner, cyanide dip, acid dips, nickel plate, chromium plate and chromium strip. There was still no attack after *840 cycles*, at which time the attempt to break down Coating 218X was abandoned!

Physically, too, Coating 218X leads. It won't chip, resists cutting and abrasion, minimizes dragout. All in all, it's easy to see why your rack coating costs will hit bottom with Coating 218X. Write today for prices.

(NOTE: Applicators nearby can bake 218X onto your racks if you have no facilities for applying it. Ask for names.)

UNICHROME

Trade Mark Reg. U.S. Pat. Off.

RACK COATINGS—Products of

UNITED CHROMIUM, INCORPORATED • 51 E. 42nd St., New York 17, N.Y.

Detroit 7, Mich. • Waterbury 90, Conn. • Chicago 4, Ill. • Dayton 2, Ohio • Los Angeles 13, Cal.

How to get Finer Finishes at Lower Costs

with GLOBE Direct Motor Drive TILTING TUMBLING BARRELS

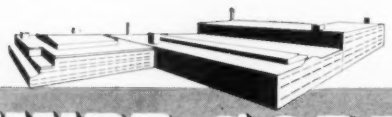
Available in Kiln-Dried Maple or Steel Shells

Process thousands of pieces at one time—faster, better and at lower cost—with Globe Precision Tumbling Barrels, dependable for 47 years. Globe's exclusive six-way work shifting motion cuts tumbling time and increases action. Speeds as low as 30 revolutions per minute assure finer finishes of non-ferrous metal parts. Motor is compactly mounted above the gear segment for space economy.

Free Experimental Service

Hupp's Experimental Engineering Laboratory can show you how to cut finishing costs. Just send samples of the parts to be processed along with a finished part. Write today! There's no charge or obligation.

Hupp Manufactures a Complete Line of Tumbling Barrels and De-Burring Machines.



HUPP CORPORATION

GLOBE STAMPING DIVISION

1250 WEST 76th STREET • CLEVELAND 2, OHIO

SERVING INDUSTRY SINCE 1902

use on polishing, buffing and grinding operations involving larger wheels and bigger volumes of dust are announced by the above firm. The changes, however, do not involve any increase in floor space requirements from the original 12″ x 20″ nor in overall height which remains at 24″, thus permitting the unit to be installed under benches or even within dust creating machines as is sometimes customary.

New ratings are due to the combined use of a ⅓ hp motor direct driving a new special hi-static paddle wheel fan —the latter being developed by the company especially for this model. Ratings given are based on actual instrument test (rather than fan calculations) and are:

437 cfm on a 4″ inlet pipe; static suction of 3.2″ water with a velocity of 7,300 fpm is developed when a test is made with a 3″ inlet pipe.

The increased capacity of the model 420 Dustkop now permits it to be used to collect the dust, lint, dirt from the following: two grinding wheels (simultaneous use) up to 7″ diameter, or one polishing or buffing wheel up to 10″ diameter, or one 9″ grinding wheel on production (surface or cutter) grinding, etc.

The sizes are given as examples and are for general guidance only; specific recommendations are available from the company without obligation.

Automatic Small Parts Cleaning Machine

L. & R. Mfg. Co., Dept. MF, 577 Elm St., Arlington, N. J.

The above firm is introducing its first completely automatic small parts

cleaning machine. This unique machine is furnished with a complete array of baskets, dividers and basket inserts, as well as with a quantity of L & R cleaning and rinsing solutions, so that the equipment can be put to work immediately upon its receipt.

To operate the L & R Automatic, simply place the parts to be cleaned in the most suitable basket, or subdivision in the basket, snap the basket on the motor shaft, and then press the starter button. The equipment is fully automatic through the cleaner in the first jar and through the rinses in the second and third jars, and in the drying chamber, which is the fourth and last stop in the machine. A complete cleaning cycle is 12 minutes. This span was determined by L & R engineers as the correct amount of time required to turn out results that would be satisfactory to the most painstaking operator, and to meet the most rigid specifications.

The machine employs hydraulic and mechanical operation for smooth, easy action. The new automatic reversing motor used in the machine is L & R's own development, and produces maximum efficiency by continuous reversing of the baskets in the solutions only. One-direction spin-off, above the solution level in each jar, is automatically controlled. This assures ultimate cleaning results and keeps solutions in better condition for longer periods of

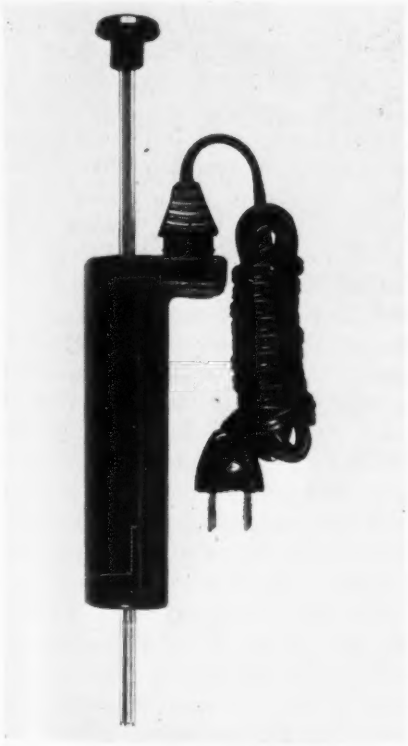
time. In the drying chamber there is controlled one-direction rotation, with drying results heightened by means of a motor-driven fan. The L & R automatic small parts cleaning machine is especially helpful for the cleaning of small instruments, gauges, clocks, ball-bearings, parking meters, jewels, electronic parts and related precision components.

Plating Thickness Measuring Instrument

Lea Mfg. Co., Dept. MF, Cherry Ave., Waterbury, Conn.

The above firm, manufacturer of polishing, buffing and burring compounds and other finishing supplies, announces the Lea Lectromag (Lipson Patent Pending), an instrument for measuring the thickness of non-magnetic coatings on carbon steel or iron. The Lea Lectromag is a simple, durable, instrument which is claimed to be capable of measuring coatings from 0.0002" to 0.008" with a plus or minus 10% accuracy for thicknesses of 0.001" and over and a plus or minus 15% accuracy for thicknesses under 0.001". Its small size, compactness and portability make it very useful in plants where articles to be checked were formerly carried to the laboratory. With this instrument, thickness measurements can be made right on the spot. It provides faster, at-the-job control, it is claimed.

Essentially, the Lectromag consists



of a solenoid about 5 inches long, encased in a holder cast of special plastic compound; 3/16" diameter glass tube with indicating scale; soft iron core with marker within this tube; suitable leads and connections. The test is made as follows: plug the leads into a source of 110 volts (variation of plus or minus 8 volts does not affect accuracy), 60 cycle power. Hold the instrument vertically over the piece to be tested, allowing the glass tube with its core to rest on the surface. Then raise the solenoid (casing) slowly, holding the glass tube in contact with the surface. Watch for a warning signal—or chattering noise—which occurs just before the core breaks its contact with the surface. At the moment the core breaks the contact, stop raising the solenoid. Still holding the glass rod on the surface to steady the instrument, allow the core to come to rest and then take the reading. It is suggested that several readings be made and the average taken. A calibrated scale comes with the set, translating readings directly into coating thicknesses. Only 110 volt, 60 cycle AC current can be used.

Wood Tanks for Cleaning Metal Tubing

Wendnagel & Co. Inc., Dept. MF, 600 W. Cermak Road, Chicago 16, Ill.

Cleaning of long lengths of metal tubes rolled from flat strip and electrically welded, is simplified through the use of these large wood tanks. Tubing in length up to 22' is lowered

Assayed Gold Plating Solutions and Salts

TOP PERFORMERS IN ANY PLATING ROOM

ROBINSON PRODUCTS are widely known and respected for their Purity, Plating Stability, Ease of Handling, Dependability and Plating Economy. ROBINSON distributes Johnson-Matthey Rhodium Solutions. Write today!

24K LIQUID GOLD PLATING CONCENTRATES—100% gold content. Complete line in a variety of colors for all specific needs. Sold by Troy wt.

POTASSIUM GOLD CYANIDE SALTS—(41%, 46%, 50% and 67.5%) Troy or Avoirdupois.

RHODIUM SOLUTIONS—We distribute Johnson-Matthey Rhodium.

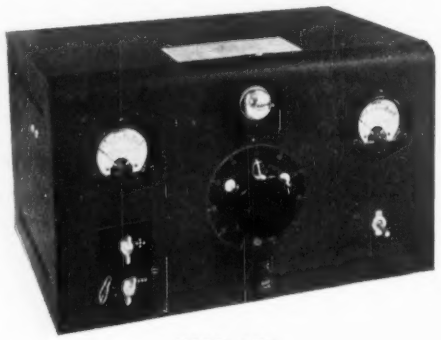
New England Representative: Harry F. Burns, 34 Wall St., Attleboro, Mass. Tel. Attleboro 2987.

A. ROBINSON & SON
"70 Years in Precious Metals"
131 CANAL STREET NEW YORK 2, N. Y.
CAnal 6-0310—0464

A. ROBINSON & SON
131 Canal Street, New York 2, N. Y.
Please send information on ROBINSON'S ASSAYED Gold Plating Solutions ( ) Potassium Gold Cyanide ( ) Rhodium Solutions ( ) Booklet: "Precious Metal Plating" ( ).
Name .....
Street .....
City ..... State .....

SELENIUM RECTIFIERS

FOR ELECTROPLATING AND ANODIZING



MODEL 3424

MODEL 1110A

Bench Model Rectifiers for continuous and reliable power. The illustrated Models 3424 and 1110A are rated at 25 and 100 amperes with Zero (0) to six (6) volts output, and are operable under a 110-120 volts, 60 cycle system. Each Unit is equipped with volt and ammeters, overload controls, extra-fine continuously variable output control, full wave conservatively rated rectifier stacks and many other latest engineering features.

Rapid Electric Rectifiers are guaranteed against defective material and workmanship and are designed to render complete satisfactory performance.

The countless number of satisfied users of Rapid Electric Rectifiers over the years can attest to their extraordinary dependability and efficient service.

Write for descriptive literature.

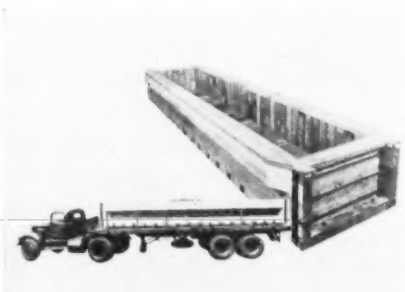
RAPID ELECTRIC CO.

2847 MIDDLETOWN ROAD, BRONX 61, N. Y.

into this tank, on an angle, by a crane. Air or steam is forced through the tubing to effect proper cleaning. When not in use for cleaning tubes the tank is used for pickling operations. Inside dimensions of tank are: 26 ft. long; 4½ ft. wide; 27 in. deep.

The advantage of using a wood tank is the high resistance of wood to acids and chemicals. The long life of wood tanks and the resistance of wood to change of shape even when alternately wet or dry make wood tanks especially practicable for use in metal working.

Bulletin No. 22 on Wood Tanks, containing complete data on performance and application, may be had by writing the manufacturer.



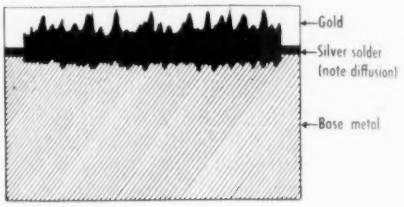
New Method of Making Rolled Gold Challenges Electroplating for Many Items

Karat Gold can now be rolled to a mirror finish and as thin as electroplate on any non-ferrous metal base through the development of the Inter-Weld Process by the Gold Filled division of the *American Silver Company, Inc., Flushing, N. Y.*

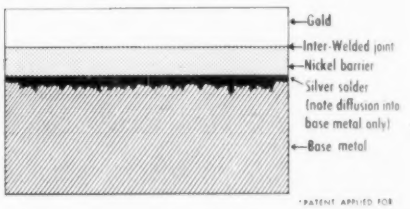
Manufacturers of fountain pens, compacts, costume jewelry, novelties, cosmetic items, buckles, buttons and a host of others will find this new method a tremendous time saver over the conventional method of manufacturing from brass and then polishing and electroplating to achieve the desirable gold color. In addition, the finished article is actually improved in quality, since the rolled gold layer is far tougher and longer wearing than a comparable thickness of gold electroplate.

Improving on the so-called "Old Sheffield Process" wherein a layer of karat gold is silver brazed to a base metal, in the ASC Inter-Weld Process

OLD METHOD



INTER-WELD METHOD



*PATENT APPLIED FOR

the gold layer is *welded* to a barrier layer of pure nickel and then this dual thickness is brazed to the base metal in the conventional manner.

In the past it has been found impossible to manufacture mechanically plated karat gold rolled down to thicknesses approaching gold electroplate because of the tendency of the silver solder used as a bonding agent to diffuse or "bleed" through to the surface of the gold and present a mottled, streaked appearance. By welding the gold layer instead of soldering it, and by the introduction of the barrier layer of nickel this "bleeding" is overcome completely. Ratios as low as 1/600 have been achieved with a karat gold thickness of 9/1,000,000th of an inch and less with a brilliant mirror finish and no sign of "bleeding," according to the above firm.

The interposition of the nickel barrier and the use of welding instead of silver solder is said to represent the first major advance in mechanical plating of precious metals since 1742

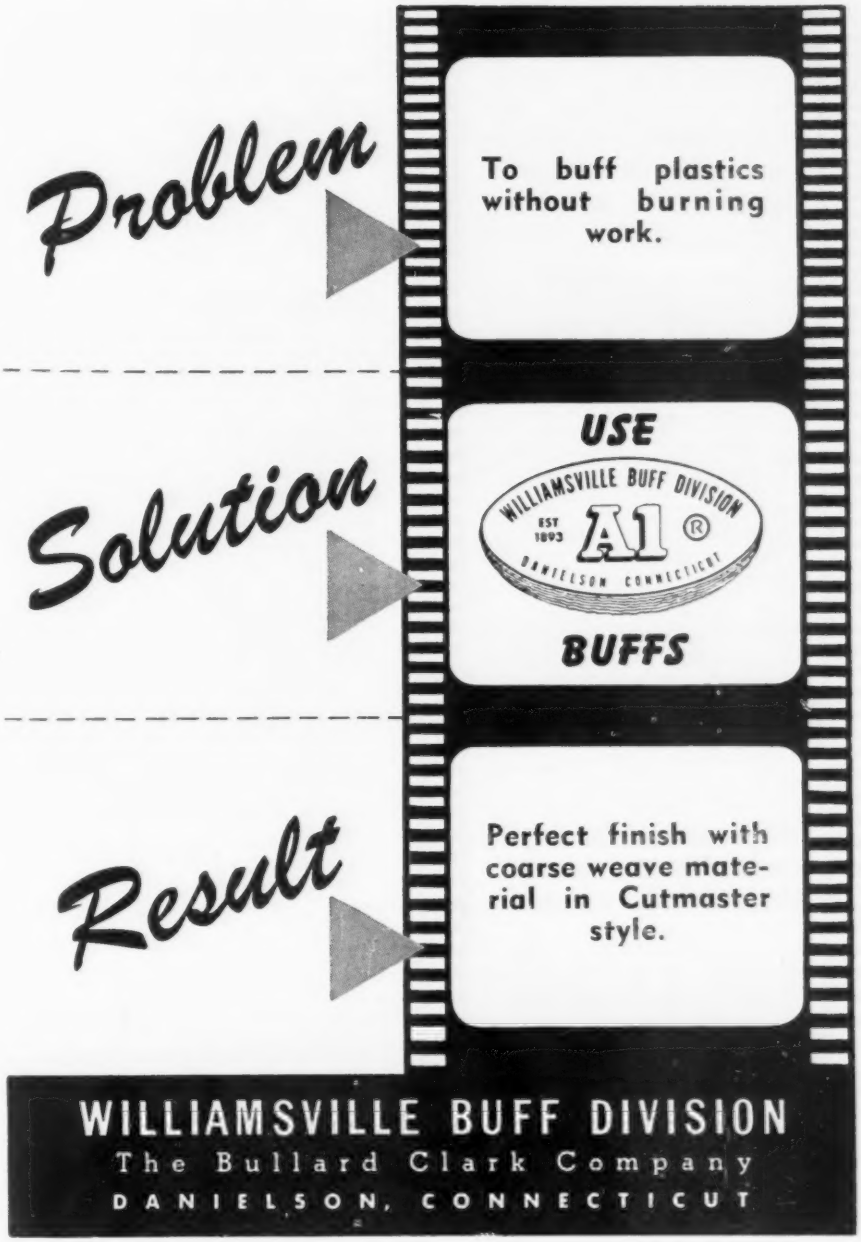
when *Bolsover*, a silversmith of Sheffield, England first developed what has since become known as the "Old Sheffield Process."

While the ASC Inter-Weld Process was developed primarily for the manufacture of rolled gold plate and gold filled, it is equally adaptable to the manufacture of silver items such as hollowware, jewelry and novelty articles now using silver electroplate.

As stated above, the effect of the ASC Inter-Weld Process on the jewelry, cosmetic, novelty and allied industries is expected to be widespread. The new method avoids the use of the expensive polishing and electroplating operations after fabrication in order to achieve the ever-popular gold color. In this instance, the resultant articles will be improved in quality because of the mirror finish and superior durability of rolled gold plate, even when as thin as electroplate. In ordinary gold electroplate the soft gold layer is usually less than 5/1,000,000th of an inch thick, being deposited on the base metal by electrical attraction, whereas in rolled gold plate the repeated processes of heat and tremendous rolling pressures are said to produce a dense, tough and durable layer of alloyed karat gold of any desired thickness.

With the ASC Inter-Weld Process the color of the gold on an article can be accurately controlled, and the color will be uniform regardless of the thickness of the gold. One or both sides of a sheet may be plated to the same or different specifications of texture, color and thickness. ASC Inter-Welded rolled gold plate is furnished in rolls, the coils interleaved with tissue or if preferred protected by a plastic strip coating which may be left on during the stamping and drawing operations.

The ASC Inter-Weld Process makes possible the production of ultra-thin rolled karat gold surfaces which can compete effectively with electroplate. It is also claimed to be a vast improvement in the manufacture of higher commercial qualities of gold filled and rolled gold plate such as are presently used in the manufacture of fountain pens, watch cases, men's jewelry, watch bands and optical items. ASC Inter-Welded gold filled and rolled gold plate can be supplied with a base of brass, nickel silver, nickel, monel, cupro-nickel or beryllium copper.



2400 Ampere Rectifier

Electronic Rectifier Co., Inc., Dept. MF, Rochester 2, N. Y.

The Type N2400CX is a newly developed low-voltage high-amperage rectifier suitable for supplying direct current for a number of industrial processes including electroplating and cleaning, electrolytic production of aluminum hydroxide for water purification processes, and production testing of D. C. motors and equipment.

SPECIFICATIONS

A. C. Input: 440 Volts 3 Phase 50/60 Cycles.

D. C. Output Voltage: Continuously Variable from 0 to 6.

D. C. Output Amps: 2400-amps-Continuous Rating.

Type of Circuit: 3 phase Wye connected to Selenium Rectifier Stacks.

Type of Cooling: Forced Air from Two 3-phase 1/6 H. P. Ball Bearing Motors.

Overload Protection:

a. Fused Safety Switch.
b. Magnetic Contactor with Thermal Overload Trip Mechanism.
c. Air Switch to guard against failure of fan motors or blocking of air passages.
d. Fuse protection for control devices & wiring.
e. Thermostats to disconnect rectifier in the event of over-heating of rectifier stacks.

On 2 counts

the **Titeflex** Filter will save you money

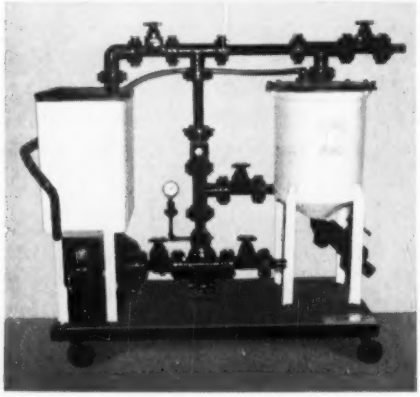
1 No replacement parts

The porous filter membrane is a permanent part of the TITEFLEX Filter—there are no expensive filter pads or asbestos sheets to replace. All you need is a few cents worth of filter aid for each batch filtered. You not only save on material costs but also in the time consumed to replace filter pads.

2 Completely self-cleaning

To clean the TITEFLEX Filter simply turn a couple of valves to reverse the flow. The "backwash" cleans the filter in ten minutes. Nothing to take out and clean—no mess—no time lost. The valuable man-hours you save can be used for more productive work elsewhere in the shop.

TITEFLEX Filters are compact, highly efficient units that give you sharp, clear filtrates with substantial savings in filter cost. Both portable and stationary models available. Write for descriptive literature.



Our new Model SLA 1000 filter with Saran-lined steel pipe and fittings and rubber-lined filter and precoat tank.

Titeflex, Inc.

546 Frelinghuysen Ave., Newark 5, N. J.

Exclusive Manufacturers of Titeflex high quality products for more than 30 years

Sales Offices: CHICAGO CLEVELAND DETROIT PHILADELPHIA LOS ANGELES BOSTON SAN FRANCISCO TORONTO

Business Items

Diversey Promotes Molis to Promotion Manager

J. P. Molis, formerly district manager of the Industrial Maintenance Department of the *Diversey Corporation, Chicago*, has been named promotional manager of the newly formed Maintenance Department, according to announcement by *W. E. Noyes*, general sales manager.

J. P. Molis

The Maintenance Department replaces two former sales departments of Diversey—Industrial Maintenance and Institutional.

Molis joined Diversey three-and-a-half years ago as a field service representative in the Industrial Maintenance Department. Soon he was promoted to district manager and assistant to the department's manager, in which position he continued until his recent promotion.

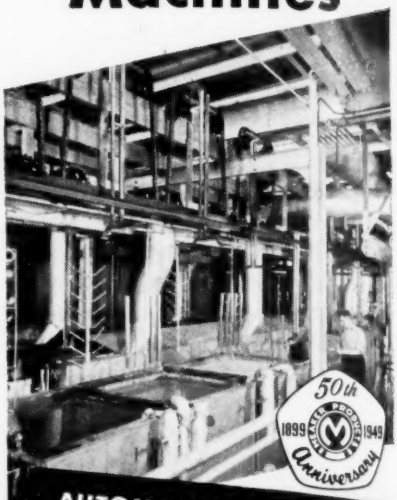
Atlas Transfers Sterling to California

Howard Sterling, a member of the supervisory staff at the *Atlas Mineral Products Company*, has been transferred to the sales department and will be located in the Southern California district.

City College to Conduct Course in Practical Electroplating

The College of the City of New York, School of Technology, will offer a course in Practical Electroplating, for the Fall Semester. The course will be given on Monday Evenings from

MEAKER
Electroplating Machines



AUTOMATIC MACHINES
STRAIGHT-A-WAY and RETURN TYPE
for mass production of large or small pieces

SEMI-AUTOMATIC MACHINES
For supplementary capacity or medium output departments

SPECIAL MACHINES
For any special plating or cleaning sequence

Equipment tailored to fit your requirements, making every operation in the plating sequence automatic, or as mechanized as possible, is the profitable way to handle electroplating on a production basis. This Meaker method applies equally well to departments with only moderate daily output and to the largest and heaviest plating needs of the mass production plants. It offers not only a lower unit cost, but the production is increased, and a better and more uniform quality is assured.

Write for the full information. Ask for Booklet 148

THE MEAKER COMPANY
1635 South 55th Ave., Chicago 50, Ill.
Telephone CRawford 7-7202

7:00 to 9:00 P.M. Registration will be held September 16th and 19th in the evening.

The primary objective of the course is to provide commercial electroplaters with a sound understanding of the principles underlying their work. For details, address Prof. W. Willig, City College, New York 31, N. Y. or phone WA 6-5400 during business hours.

Hall Transferred to Toronto Office of American Wheelabrator

Effective August 1 *Watson P. Hall* will join *Robert Campbell* in the Toronto, Ontario sales office of *American Wheelabrator & Equipment Corp., Mishawaka, Indiana.* For the past three years Mr. Hall has been a member of the service engineering staff of this same organization.

Previous to joining American Wheelabrator & Equipment Corp. in 1936, he was associated with Consolidated Mining and Smelting Works, North Ontario and Nova Scotia, and with the Sullivan Mines in British Columbia. During the last war he served with the RCAF in England.

Mr. Hall is a graduate of McGill University, Montreal, with a degree in Mining Engineering and is a member of the Canadian Institute of Mining and Metallurgy.

Dr. Brodeur Joins Pyrene Metal Finishing Division

The appointment of *Dr. Paul J. Brodeur* as Chief Chemist of the Metal Finishing Division of the *Pyrene Manufacturing Co.*, Newark, New Jersey, has been announced by *L. E. Eckelmann*, Manager of the division. At the same time, Eckelmann indicated that there would be a marked expansion of the Metal Finishing Division involving a considerable increase in size of plant area and production facilities.

This division of the company was formed originally to handle the metal finishing of the company's own fire extinguisher products. For years, however, it has been doing a large volume of job work for other manufacturers, parts and repair companies and plating jobbers. In addition, it installs, for other companies, various metal finishing processes, including their own Pyrene Bright Nickel.

Dr. Brodeur, who has had wide experience as a technical expert in metal finishing, has devoted specialized attention to the field of hard chromium plating. For more than five years he served as a Major in the Chemical Warfare Service. He received his B.S. degree from Penn State in 1929, his Master's degree from University of Minnesota in 1932 and his Ph.D. from Columbia in 1940.

McKinley Goes to Hooker-Detrex

Effective August 1, 1949, *H. D. McKinley* has been appointed Works Manager of the new degreasing-solvent manufacturing plant being erected by *Hooker-Detrex, Inc.*, at Ashtabula, Ohio.

Mr. McKinley, who collaborated in the design, erection and initial operation of the Tacoma, Washington, plant of the Company, is transferring from his position as manager of the solvents division of Detrex Corporation.

Hooker-Detrex, Inc., is a jointly owned subsidiary of *Hooker Electrochemical Company, Niagara Falls, New York*, and *Detrex Corporation, Detroit, Michigan.* Detrex Corporation markets all the solvent produced by the subsidiary company

BUCKINGHAM PRODUCTS

TRIPOLI

Labor-Cost is High—
Get an Extra "Helper" FREE!

THERE IS A "HELPER" IN EACH BAR OF TRIPOLI LISTED BELOW—A helper for cleaning operations, a big time and labor saver.

These new compounds contain solubilizing agents to insure easy removal in weak alkaline cleaning solutions . . . Especially adapted for use on die cast parts. All surface blemishes removed with minimum effort . . . a high luster easily obtained.

Write for Samples of these Die Cast Grades

T-401
T-605
T-607

REPRESENTATION FROM COAST TO COAST

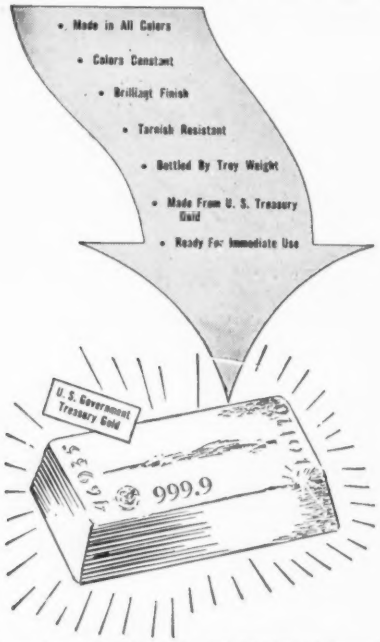
The BUCKINGHAM PRODUCTS Co.
14100 FULLERTON AVE. • DETROIT 27, MICH.

DAVIS-K

GOLD & RHODIUM

SOLUTIONS

GOLD and RHODIUM PLATING SOLUTIONS HEADQUARTERS


• Made in All Colors
• Colors Constant
• Brilliant Finish
• Tarnish Resistant
• Bottled By Troy Weight
• Made From U. S. Treasury Gold
• Ready For Immediate Use
U. S. Government Treasury Gold
999.9

DAVIS-K—makers of GOLD PLATING SOLUTIONS—prepared in all colors that produce hard, tarnish-resistant, color constant deposits.

Compounded from U. S. Treasury GOLD and highest (C.P.) chemicals. Sold by troy weight—certified 100% gold content.

Solutions are simple to operate and maintain.

We are fully equipped to reclaim your old gold, rhodium and silver solutions. Also wires or racks that have been used for precious metal plating.

We welcome inquiries pertaining to precious metal plating problems.

Distributors of Bakers' lustrous RHODIUM SOLUTIONS, that produce a long-lasting white finish.

"Where glittering elegance reflects lasting quality"

DAVIS-K PRODUCTS CO.

54 West 22nd Street ORegon 5-0094-5 New York 10, N. Y.

Corrosion Proofing Firm Reorganizes

The *Electro-Chemical Supply and Engineering Co. of Paoli, Penna.*, one of the oldest firms in the acid and corrosion proofing field, announces a complete reorganization. The new officers and key men aggregate approximately a century of experience in this highly technical and specialized work. In addition to existing facilities, a new plant with 16,000 square feet of floor space is being fully equipped at Emmaus (Allentown), Penna.

The officers of the company are: *Dr. C. R. Payne*, President; *J. Wm. Grant*, Vice President and Sales Manager; Wm. A. Sesher, Treasurer and Production Manager; *Walter L. Sheppard, Jr.*, is Advertising Manager and Export Sales Manager.

The Electro-Chemical Supply and Engineering Co. was founded in 1912, and was one of the first companies in the United States established to manufacture acid-proof cements, and to engineer acid-proof construction. It claims to be the first company in the United States to manufacture a two-part fast setting silicate cement (Duro), and the first to manufacture and install Thiokol plasticized sulphur cement—then called Thiogrout, now known as Brimsto.

Spencer Henn Joins United Chromium

Spencer L. Henn has joined the staff of United Chromium, Incorporated as Field Sales and Service Engineer for the New England area. He will provide technical service to chromium plating clients of United Chromium and will also sell and service the complete line of Unichrome products and processes including rack coatings, stop-offs, copper, dips for zinc and cadmium, and strips.

Mr. Henn is a graduate of Yale University with a Ph.B. in Chemistry. Since his graduation he has served the metal finishing industries of Connecticut and Massachusetts as a representative of Apothecaries Hall Co. He is

Spencer L. Henn

well known in this territory for having developed metal cleaning and buffing materials and for servicing and installing equipment and processes for plating zinc, cadmium, bright copper, bright nickel, and chromium.

Warnes New Turco Sales Promotion Head

Turco Products, Inc., of Los Angeles, Calif., manufacturers of industrial cleaning compounds, announce the appointment of *F. E. Warnes* as director of sales promotion.

Prior to this assignment, Warnes has held the position of sales supervisor for the seven states of the Pacific Northwest.

Warnes will be headquartered in Turco's main offices in Los Angeles.

Goory to Represent Amercraft in Ohio

Amer-craft Products, 1024 *South California Avenue, Chicago* 12, *Ill.*, manufacturers of buffs, announce the appointment of *John E. (Jack) Goory, Jr.*, as its sales representative in the Ohio area. Mr. Goory, a mechanical engineer, was an engineering officer

with the 96th Bomb Squadron, 49th Bombardment Squadron and the 18th Anti-Submarine Squadron in World War II, winning the air medal and six battle stars. He has had intensive experience in machinery designing and technical development and has done extensive sales engineering in the North Ohio sales area.

Copson Heads Mutual Chemical Research

Dr. Raymond L. Copson has been appointed Director of Research of the *Mutual Chemical Company of America* as of July 1st, with headquarters in Baltimore. Dr. Copson was formerly Director of Research for the Rumford Division of the Heyden Chemical Corp.

During and prior to the last war, Dr. Copson was chief of research and engineering for the Tennessee Valley Authority, a major producer of phosphorus and ammonium nitrate. He is the author of a number of papers on phosphate technology and other branches of inorganic chemistry. He is a member of the American Institute

Dr. Raymond L. Copson

of Chemical Engineers, the American Chemical Society, and the Chemists' Club, N. Y. He holds degrees from Worcester Polytechnic Institute and Yale University.

Torit Manufacturing Company Expands

The *Torit Manufacturing Co.* is adding a sheet steel fabricating department to its main plant in St. Paul, Minn. Work is nearly finished in the consolidation and rearrangement of the other departments to make room for this new manufacturing division, and the installation of brakes, shears and other equipment was completed in mid-July.

When these changes are completed Torit will be doing its own fabrication of the cabinets for its dust collecting equipment. These were formerly made to Torit specifications by another St. Paul firm. It is expected that these changes will speed up production and improve deliveries of these machines.

In addition to dust collecting equipment for grinders, polishing machines, etc., used in industrial plants throughout the country, Torit manufactures dental supplies and equipment, and a branch plant in St. Paul manufactures filters for the dust collectors, along with a number of cloth specialties.

Atlas Mineral Makes Several Appointments

Mr. George P. Gabriel, who recently received a degree in Chemical Engineering at Penn State College, has accepted a position as engineer with *The Atlas Mineral Products Company* at Mertztown, Pennsylvania.

Arthur F. Wirtz, Jr., and *George L. Wirtz, Jr.*, grandsons of the late M. F. Wirtz, founder of the firm, have also joined the company, being assigned to supervision and sales departments respectively at Mertztown, Pa.

It has also been announced that *Mr. Edison Sickman* has been appointed District Sales Manager of the Middle Atlantic territory of the company.

Since the Beginning of Mass Production

BLAKESLEE

Has Pioneered and Developed METAL PARTS WASHERS

The first metal parts washer was built by Blakeslee . . . an outstanding contribution to mass production methods. Today, Blakeslee metal parts washers are familiar throughout the automotive, aviation and countless other industries.

Whether your finishing operation is enameling, lacquering, machine plating or inspecting, you can depend on a Blakeslee washer. Blakeslee spray, power spray, spiral tumbling or the exclusive Niagara power paddle washing principles, provides a right cleaning method for every type of operation.

Pickling machines, Quenchers and Solvent Vapor Degreasers are also manufactured by Blakeslee. Here you'll find everything you need to prepare your product for finishing.

Engineered for You!

Our experienced staff of practical engineers is ready to help you with your cleaning problems.

G. S. BLAKESLEE & CO.

BLACOSOLV DEGREASERS AND SOLVENT

NIAGARA METAL PARTS WASHERS

G. S. BLAKESLEE CO., CHICAGO 50, ILLINOIS
NEW YORK, N. Y. TORONTO, ONT.

Pennsalt Introduces New Plant in Kentucky

The *Pennsylvania Salt Manufacturing Co.* introduced its new $2,000,000 chemical plant on June 21, 1949, with an open house attended by more than 1,500 people, mostly from the local area. Company officials were on hand to greet visitors, who were taken on a guided tour of the operation. Special displays exhibiting the company's products were set up in the plant's warehouse.

The previous evening *George B. Beitzel*, president of Pennsalt, delivered the principal address at the annual dinner-meeting of the Association of Commerce in Paducah. Beitzel told nearly 1,000 guests at the meeting that hydrofluoric acid, which will be produced at the new plant, plays a vital role in the development of atomic energy.

Visitors were presented with a specially prepared booklet entitled "Progressive Chemistry for 99 Years."

The new plant will employ 50 people from the Calvert City-Paducah area during its initial stages and will operate 24 hours a day. Production began in July.

Rylander to Head Canadian Permag

Mr. Allan A. Rylander has been elected President of *Canadian Permag Products, Ltd.* This announcement is made by *Mr. Edward Magnuson*, founder, who is now Chairman of the Board.

Allan A. Rylander

Canadian Permag Products, Ltd., manufactures Permag specialized industrial cleaning compounds in Canada. They render technical service as well as sell these compounds.

After five years with a private bank on Wall Street, Mr. Rylander joined Magnuson Products Corporation in Brooklyn in 1929. He went to Montreal in 1933 as Assistant Manager of Canadian Permag. In 1937, he became Assistant Treasurer and Manager, and in 1943 he became Treasurer. He was elected Director in 1944 and made General Manager in 1946. Mr. Rylander is also a Director of Magnuson Products Corporation in Brooklyn.

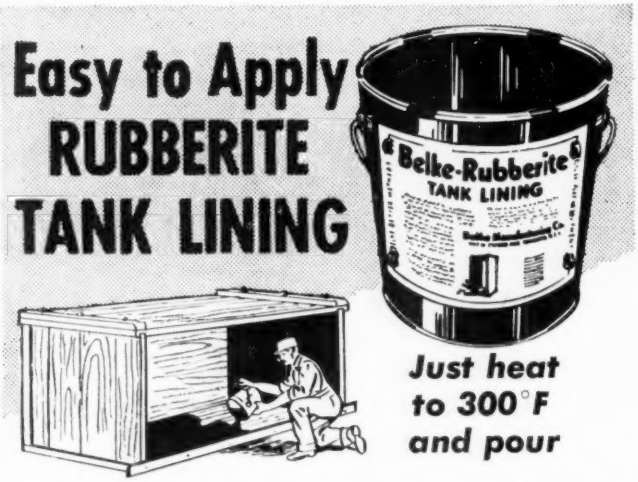
Harshaw President Receives Honorary Degree

On June 15 last, Western Reserve University awarded the honorary degree of Doctor of Science to *Mr. William J. Harshaw*, President of *The Harshaw Chemical Company* in recognition of his scientific discoveries in the fields of ceramics and electroplating.

Michigan Abrasive Company Streamlines Price Schedules

Mr. Max Jones, president of *Michigan Abrasive Company, Detroit*, announces the streamlining of the

Easy to Apply RUBBERITE TANK LINING



Just heat to 300°F and pour

Provides a lasting lining that withstands acids and caustics at room temperatures. A standby of Platers for over 25 years. Effectively protects wood or steel tanks. Easily applied in your own shop—just turn tank on side and fasten board on edge as illustrated. Then heat Belke Rubberite to 300° F. and pour over surface. Surfaces to be coated require no special preparation but should be reasonably clean.

When Rubberite cools, it has characteristics similar to soft rubber. Will not crack, scale, or run in the hottest weather. Write for complete information.

Belke MANUFACTURING CO.
947 North Cicero Ave.
Chicago 51, Ill.
EVERYTHING FOR PLATING PLANTS

1948
GUIDEBOOK-DIRECTORY
$1.50 PER COPY

•

METALLIZING NON-CONDUCTORS
$2.00 PER COPY

•

DICTIONARY OF METAL FINISHING CHEMICALS
$3.00 PER COPY

•

All Book Orders Payable in Advance

METAL FINISHING
11 WEST 42nd ST., NEW YORK 18, N. Y.

company's abrasive prices. For years abrasives have been priced with a series of chain discounts, a method now abandoned by Michigan Abrasive Co. The new set-up calls for a single discount which makes the figuring of costs and resale prices much easier. This change is brought about in order to fully cooperate with the trade who have wanted simplified pricing for some time, and is considered by many as a step in the sale of abrasives that will prove a real time saver and a great convenience.

Texo Corp. Elects New President

Mr. Boris Sway has been elected president of the *Texo Corp., Cincinnati, Ohio,* it was announced recently at the annual meeting of the Board of Directors. Sway, who has played a prominent part in the research concerning the development of detergents, has been vice-president in charge of production at Texo since its inception several years ago.

Prior to his association with Texo, Sway acted as consultant for two companies specializing, like Texo, in the production of surface active chemicals

Boris Sway

for maintenance and processing in all branches of industrial and institutional activity. He is a graduate in Chemical Engineering of the University of Cincinnati. *Don Bertke* was elected vice-president at the meeting.

CHROMIC ACID

99.75% PURE

MUTUAL CHEMICAL CO. OF AMERICA — MUTUAL — NEW YORK N.Y. — SINCE 1845 — REG U.S. PAT. OFF.

SODIUM BICHROMATE

POTASSIUM BICHROMATE

MUTUAL CHEMICAL COMPANY OF AMERICA

270 Madison Avenue, New York 16, N. Y.

Morgan Jones Made Plant Superintendent at Maneely

Maneely Chemical Co., of Phila., Pa., announces the appointment of *Mr. Morgan Jones* as superintendent of their plant at Wheatland, Pa.

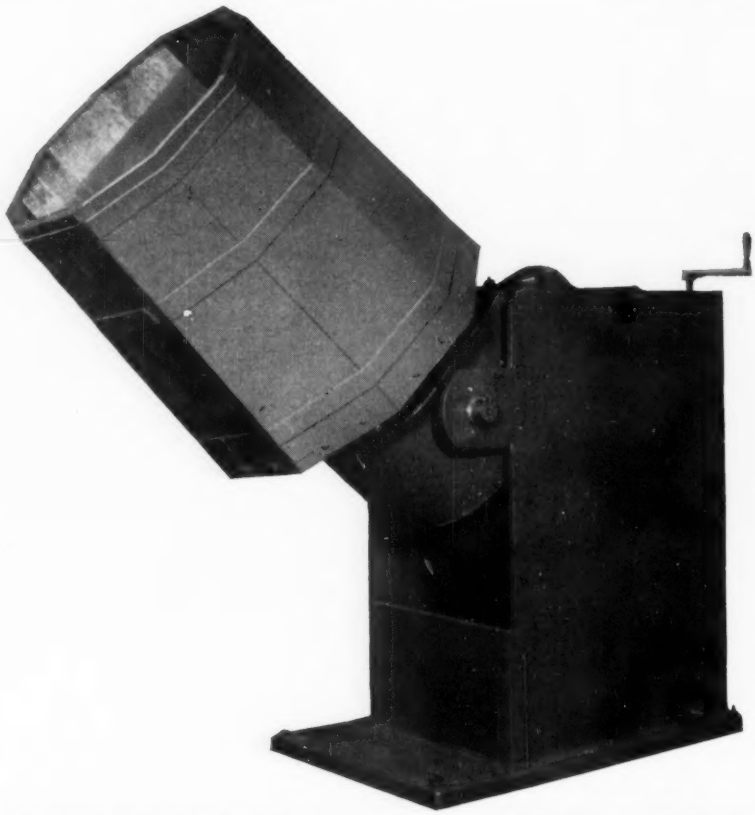
Mr. Jones graduated as a Chemical Engineer from the Ohio State University where he was a member of Phi Delta Theta, Tau Beta Pi, and editor of "Ohio State Engineer," the engineering college magazine. After graduation, he became production supervisor for the Monsanto Chemical Company at Nitro, W. Va., did research in chromic oxide and iron oxide pigments for C. K. Williams & Company at Easton, Pa., and was Engineer and Chemical Plant Superintendent in the manufacture of phosphorus, phosphoric acid, sulfuric acid and superphosphate for the Phosphate Mining Company at Nichols, Florida. Mr. Jones comes to the Maneely Chemical Co. directly from the Calco Chemical Div. of American Cyanamid Company at Marietta, Ohio, where he has been Production Superintendent since 1945.

Promotions at Detrex

A. O. Thalacker, vice president and general manager of *Detrex Corporation,* manufacturers of equipment and chemicals for production cleaning in industrial plants and drycleaning establishments, has announced the following advancements effective immediately:

R. A. Emmett, Jr., has been made a special assistant to the general manager to supervise material control, production scheduling, inspection, and safety.

J. Doyle Hamacher has been made



ANNOUNCING THE NEW PESCO TILTING TUMBLER

SOLID STEEL STAND—NO RATCHET—AUTOMATIC LOCK—ANY POSITION JUST BY A TURN OF THE HANDLE—AVAILABLE WITH EITHER OCTAGON WOOD OR STEEL OR ROUND STEEL TUB—REPLACEMENT PARTS ALWAYS IN STOCK.

(PLEASE WRITE FOR ADDITIONAL INFORMATION.)

We carry a complete line of Plating, Polishing, Baking and Spraying Equipment and Supplies.

PESCO PLATING EQUIPMENT CORP.
182 Grand St., New York 13, N. Y.
CAnal 6-3010-1-2

superintendent of the equipment manufacturing plant. He will also retain his previous title and duties as company plant engineer.

Erich Joins Atlas Mineral Products

Earl Erich, a recent graduate of Muhlenberg College, has accepted a position in the Research Laboratories of *The Atlas Mineral Products Co. at Mertztown, Penna.*

Obituary

SAMUEL ALSOP, SR.

Samuel Alsop, Sr., President of the *Alsop Engineering Corp.*, of Milldale, Conn., since its inception thirty years ago, and holder of numerous patents, died July 7th of a heart attack at his summer home at Madison, Conn.

Born at Delaware Water Gap, Pennsylvania, Mr. Alsop was a New York Electrical School graduate. He showed inventive talents at an early age, and at 24 had patented his first Filter and organized the Alsop Engineering Company the same year in New York City. The concern moved to Milldale, Connecticut, in 1930.

Mr. Alsop built the firm from a one-man shop into an enterprise that employs 130 people and maintains offices or representatives in every major city in the United States and in South America and Europe.

Mr. Alsop was affiliated with a New York City Lodge of A.F. and A.M. He leaves three sons, Samuel Alsop, Jr., Edmund Bell Alsop and Carter Griscolm Alsop of Meriden, Connecticut, and one sister, Miss Beatrice Alsop of New York City.

FELLOWSHIP CLUB

(Concluded from Page 43)

2nd—*Ken Robins*, of G. S. Robins & Co., St. Louis. 138-66-72

3rd—*Bob Tucker*, of Wyandotte Chemical Co. 114-41½-72½

4th—*Theron Loveland*, of Republic Steel Co. 137-64-73

Jim Badaluco, in addition to having the lowest gross score for the day, also had the lowest net and was awarded permanent possession of the beautiful Fellowship Golf Championship Trophy, a duplicate of which will go to the winner of this event in future years. The others listed above received suitable awards donated by the Fellowship Club.

Other notable low-gross scores, in addition to Jim Badaluco's 82 were:

H. C. Irvin—Allied Research Corp., Baltimore, 84

Paul Savage—McGean Chemical Co., Cleveland, 88

Frank Griggs—Canadian Hanson-Van Winkle-Munning Co., 89

Walter Raymond—Editor—*Metal Finishing*, 89

Rudy Hazucha—Clinton Co., Chicago, 92

Mr. N. A. Glenn, of the Minneapolis-Honeywell Regulator Co. scored a deuce on the very tricky fifth hole.

In the absence of *Joe Duffy*, perennial chairman of the golf tournament,

Jim Badaluco
Winner of Fellowship Golf Tournament

International Fellowship Club Golf Trophy. Each year a duplicate will be awarded to the winner of the Handicap Tournament held at the Annual Convention.

M.F. 849

the details were handled by *Johnny Schneider*, of Pennsylvania Salt Mfg. Co., Milwaukee, assisted by *Walter Raymond*, of *Metal Finishing*.

Associations and Societies

NATIONAL ASSOCIATION OF METAL FINISHERS

At the Annual Meeting of the Association held in Milwaukee in conjunction with the Annual Convention of the American Electroplaters Society, the following officers were elected to head the NAMF for the coming year:

President—Harold E. Coombes, Pasadena, Calif.

First V.P.—W. O. Zinn, Chicago, Ill.

Second V.P.—William F. Walton, Attleboro, Mass.

Third V.P.—F. A. Truden, Nashville, Tenn.

Treasurer—Gerald Burgess, Detroit, Mich.

Secretary—Raymond M. Shock, Detroit, Mich.

AMERICAN SOCIETY FOR METALS

Annual Convention Notes

The technical program of the American Society for Metals at the 31st annual Metal Congress and Exposition in Cleveland, Ohio, October 17-21, 1949, has been approved by the ASM Publications Committee, according to an announcement made by *W. H. Eisenman*, the Society's National Secretary.

Nine sessions are scheduled for the five days of the October meeting.

The technical program just approved is in addition to the daily round table discussions of the Metal Show's central theme, "Economy in Production" and the Saturday and Sunday Symposiums on "Thermodynamics in Physical Metallurgy" which precedes the Exposition opening on Monday, October 17th.

Chairman of the Committee which passed on the October technical sessions is *Robert H. Aborn*, Department of Physical Metallurgy, United States Steel Corp. Subjects covered will include "Alloy Steels," "Oxidation," "Quenching," "High Temperature," "Transformation in Steels," "Temper Brittleness," "Stainless Steels," "Mechanical Metallurgy," "Nonferrous Metals," and "Atomic Energy Metallurgy."

AMERICAN CHEMICAL SOCIETY

Pacific Industrial Conferences

Twenty thousand chemists, chemical engineers, and industrial executives from all over the nation and many other countries are expected to attend the Pacific Industrial Conferences which will run concurrently with the Pacific Chemical Exposition at the San Francisco Civic Auditorium, November 1-5, 1949.

There will be fourteen one- and two-day conferences presented by the following organizations:

PERMAG
CLEANING COMPOUNDS
for the Electroplating INDUSTRY
Still Tank Cleaning
Steel Cleaning
Copper, Metals and Alloys
White Metal
Electric Cleaning
Tumbling and Burnishing
Cleaning Aluminum
PERMAG
Did you get our Newest FOLDER for Electroplaters?
—We send it on request—Use Coupon
Illustrations in our FOLDER show the various cleaning operations in which PERMAG is used so successfully. A Plating Room layout is also shown, representing the different Units in operation in a well planned plating room.
MAGNUSON PRODUCTS CORPORATION
Mfrs. Specialized Cleaning Compounds
Main Office 50 Court St.
BROOKLYN 2 N. Y.
Nationally Represented
In Canada: Canadian PERMAG Products Ltd., Montreal, Que.
Clip the COUPON and send to us at once
MAGNUSON PRODUCTS CORP., 50 Court St., BROOKLYN 2, N. Y.
Please send Folder M, illustrated above.
Name
Company
Address
City
State

Agriculture and Food Chemistry Division, American Chemical Society, California Section
American Institute of Chemical Engineers, Northern California Section
American Institute of Mining Engineers
California Redwood Association
Federation of Paint & Varnish Production Clubs
Forest Products Research Society, Northern California Section
Market Research Department, San Francisco Chamber of Commerce
Northern California Instrument Association
Northern California Rubber Group
Pacific Insecticide Institute
Petroleum Division, American Chemical Society, California Section
Society of the Plastics Industry, San Francisco Section
Western Market Research Group
World Trade Department, San Francisco Chamber of Commerce

These programs will present many world-famous speakers and subjects vital to the continued industrial growth of the nation.

AMERICAN SOCIETY FOR TESTING MATERIALS

Medalists and Award Winners at Annual Meeting

The CHARLES B. DUDLEY MEDAL, named after the Society's first President, and awarded to the author or authors of a paper of outstanding merit constituting an original contribution on research and engineering materials, was presented to six men: *W. W. Buechner, R. J. Van de Graaff, H. Feshbach, A. Sperduto,* on the staff of Massachusetts Institute of Technology, Cambridge, Mass., and *E. A. Burrill* and *L. R. McIntosh,* formerly on the staff of M.I.T., now with High Voltage Engineering Corp., Cambridge, Mass., for their paper on "An Investigation of Radiography in the Range from 0.5 to 2.5 million Volts," published in the December, 1948, issue of ASTM BULLETIN.

The RICHARD L. TEMPLIN AWARD, to stimulate research in the development of testing methods and apparatus and to encourage the presentation to the Society of papers describing new and useful testing procedures and apparatus, was given to *W. T. Lankford,* Research Associate, Research and Technology Dept., Carnegie-Illinois Steel Corp., Pittsburgh, Pa., for his paper on "Hydraulic Bulge Testing of Sheet Metals," presented at the 1948 meeting and published in the Symposium on Deformation of Metals as Related to Forming and Service, A.S.T.M. STP No. 87.

The SANFORD E. THOMPSON AWARD, to recognize a paper of outstanding merit on concrete and concrete aggregates, was given to *R. C. Mielenz* and *L. P. Witte,* Head of Petrographic Laboratory and Durability Unit Materials Laboratories, respectively, Bureau of Reclamation, United States Department of the Interior, Denver, Colo., for their paper on "Tests Used by the Bureau of Reclamation for Identifying Reactive Concrete Aggregates," presented at the 1948 meeting and in the PROCEEDINGS.

The first SAM TOUR AWARD, to encourage research on the improvement and evaluation of corrosion testing methods and to stimulate the prep-

PARAMOUNT BRAND
FELT WHEELS

Are you finishing articles which require a wheel with a "shaped" or contoured face? Don't forget that felt wheels lend themselves to contouring probably better than any other type of wheel. Don't forget, too, you have nine degrees of hardness to choose from when you buy Bacon Felt Wheels' —The Paramount Brand. Ask your supply house for Paramount Brand Felt Polish Wheels.

...TOPS IN "Contourability"

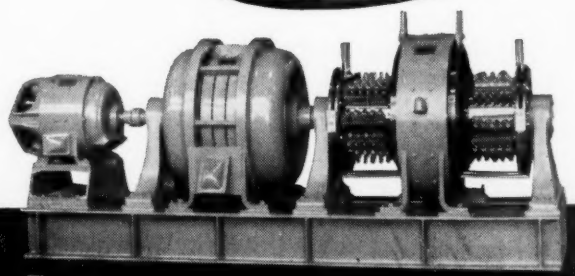
Your Supply House Can Furnish Bacon PARAMOUNT BRAND FELT WHEELS & BOBS

SEND FOR OUR NEW CATALOG

BACON FELT COMPANY
Established 1824

WINCHESTER "America's Oldest Felt Manufacturer"
MASSACHUSETTS Felt Does It Better

Motor Generators by COLUMBIA



For
Electroplating — Anodizing
Electrocleaning — Electropolishing

There's a Columbia M-G Set available for your needs, whether you have a small plating bath or a large continuous strip plating line. Capacities up to 20,000 Amperes; 6 Volts and up. Dependable, performance proved, for many years. Your inquiries solicited.

Write today for Catalog MF-700

COLUMBIA ELECTRIC MFG. CO.
4529 HAMILTON AVENUE CLEVELAND 14, OHIO

aration of technical papers in this field, was given to *V. M. Darsey* and *W. R. Cavanagh*, President and Research Chemist, respectively, Parker Rust Proof Co., Detroit, Mich., for their paper on "Apparatus and Factors in Salt Fog Testing," presented at the 1948 meeting and published in the PROCEEDINGS.

New Officers

James G. Morrow, Metallurgical Engineer, The Steel Company of Canada, Ltd., Hamilton, Ontario, was elected President for 1949-1950, succeeding *R. L. Templin*, Assistant Director of Research and Chief Engineering of Tests, Aluminum Company of America, New Kensington, Pa., who continues on the Board of Directors as Past-President for three years.

Frank E. Richart, Research Professor of Engineering Materials, University of Illinois, Urbana, Ill., is the new Vice-President to serve with the Senior Vice-President, *L. J. Markwardt*, Assistant Director, U. S. Forest Products Laboratory, Madison, Wis.

The new members of the Board of Directors are as follows: *R. D. Bonney*, Assistant Manager of Manufacturing, Congoleum-Nairn, Kearny, N. J.; *C. H. Fellows*, Head, Chemical Division, Research Department, The Detroit Edison Co., Detroit, Mich.; *H. F. Gonnerman*, Assistant to Vice-President for Research and Development, Portland Cement Association, Chicago, Ill.; *N. L. Mochel*, Manager, Metallurgical Engineering, Westinghouse Electric Corp., Philadelphia, Pa., and *M. O. Withey*, Dean of Engineering, University of Wisconsin, Madison, Wis.

ELECTROCHEMICAL SOCIETY

The Ninety-Sixth Convention of The Electrochemical Society will be held at the La Salle Hotel, Chicago, Illinois, on October 12, 13, 14, and 15, 1949.

Symposia are being scheduled on Electrodeposition, Corrosion, and Organic Electrochemistry. Special round table sessions are being scheduled on Batteries and Organic Electrochemistry.

Additional information may be obtained by writing to *Henry B. Linford*, Secretary of The Electrochemical Society, 235 West 102nd Street, New York 25, N. Y.

IRIDITE

Iridite is quickly applied manually or automatically, to large or small parts

on Galvanized

Rheem

(Series 41)

HOT WATER TANKS

gives

LONGER LIFE

BETTER SERVICE

If your products use ZINC or CADMIUM in any form, you'll want to know about Iridite, the non-electric chemical coating that offers you 3-way protection—

√ guards against corrosion on zinc or cadmium—lengthens product life.

√ gives better paint adherence on zinc or cadmium—improves entire finishing system.

√ brightens zinc or cadmium—keeps it bright and shining to help boost sales. Also available in colors.

Whatever your needs in finishing zinc or cadmium, there's an Iridite to do the job. Write today for FREE FOLDER and full information—or better still—send samples of your product for free treatment.

FREE!

Please send me illustrated folder and sample panels of Iridite.

NAME.....

COMPANY.....

ADDRESS.....

.....

PRODUCTS.....

ALLIED RESEARCH PRODUCTS, INC.

4004 EAST MONUMENT STREET

BALTIMORE 5, MD.

WEST COAST LICENSEE—L. H. BUTCHER CO., LOS ANGELES 23, CALIFORNIA

PLATING AND POLISHING EQUIPMENT AND SUPPLIES

CLEAN-RITE ALL PURPOSE CLEANERS

PLATING RACKS • BUFFS • COMPOSITIONS

• • •

Let us help you solve your Finishing Problems.
Costly rejects can be reduced and the Finish improved.
Take advantage of our Practical Experience.

JACOB HAY COMPANY

Centralized Distributors

4014 WEST PARKER AVE. CHICAGO 39, ILL.

TEL. CAPITOL 7-8800

Metal Trades Ass'n Annual Convention

The National Metal Trades Association announces its 1949 Annual Convention for Wednesday, Thursday, and Friday, October 26, 27, and 28, 1949 at the Palmer House, Chicago, Illinois. This marks the Association's Golden Anniversary since it was founded in 1899.

Thomas J. Horton, Jr., President of the Hoosier Cardinal Corporation, Evansville, Indiana, is President of the Association. The First Vice President is *Joseph L. Kopf*, President of Jabez Burns & Sons, Inc., in New York, and the Second Vice President and Treasurer is *Philip M. Morgan*, President of the Morgan Construction Company, Worcester, Massachusetts.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS

Meeting in Dallas

Eight technical papers on various corrosion problems, a panel discussion and various committee meetings have been scheduled for the annual meeting of South Central Region, *National Association of Corrosion Engineers* to be held at the Adolphus Hotel, Dallas on October 3 and 4.

Requests for the official program of the meeting are being received by *A. B. Campbell*, Executive Secretary NACE at 919 Milam Bldg., Houston 2, Texas.

Eight technical papers are scheduled for presentation. The titles of the papers and authors are:

"Causes of Corrosion in Airplanes and Methods of Prevention," by *N. H. Simpson*, Consolidated Vultee Aircraft Corp., Fort Worth, Texas.

"Selection of Protective Coatings for Fume Resistance," by *C. C. Harvey*, Ethyl Corp., Baton Rouge, La.

"Internal Corrosion of Crude Oil Tanks," by *W. H. Crenshaw*, American Inspection Service, Midland, Texas. This paper is sponsored by the Permian Basin Section NACE, members of which are assisting in collecting data.

"Control of Vapor Zone Corrosion in Storage Tanks by the Use of Ammonia," by *S. T. Gardner* and *A. T. Clothier* of The Carter Oil Co., and *Francis Coryell* of Interstate Oil Pipe Line Co., Tulsa, Okla.

"Corrosion Control on Gas and Water Distribution Systems in Texas Low-Rent Housing Projects," by *C. R. Goodrich*, Fort Worth, Texas.

"Thermofor Catalytic Cracking Gas Plant Corrosion Survey," by *C. A. Murray*, The Pure Oil Co., Nederland, Texas.

"Combating Corrosion in a Chemical Plant with Magnesium Anodes," by *Oliver Osborn*, The Dow Chemical Co., Freeport, Texas.

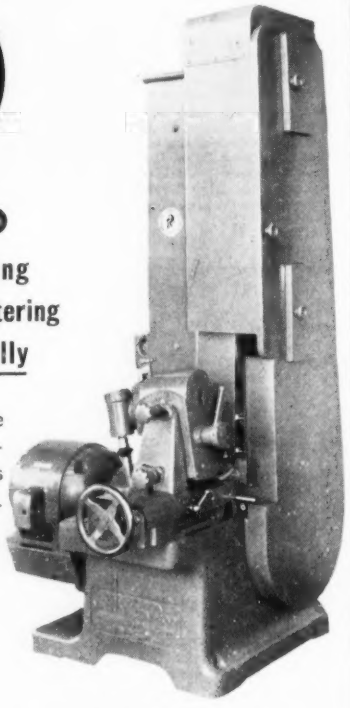
"Application of Magnesium Anodes to Pipe Line Protection," by *J. A. Holloway*, Houston Pipe Line Co., Edna, Texas.

A feature of the program considered to be of major interest to persons interested in corosion mitigation methods will be a panel-type discussion devoted to problems in pipe lines, refining, chemical, water works, production, transportation and other industries. *L. F. Scherer*, Texas Pipe Line Co., Houston, Texas, will act as moderator. Other members of the panel include *F. L. LaQue*, The International Nickel Co., Inc., New York, N. Y.; *W. F. Rogers*, Gulf Refining Co., Houston, Texas; *William E. Huddle-*

POLISHING MACHINE
CENTERLESS FEED

HIGH SPEED
Polishing and Finishing
No Chucking • No Centering
Just Feed Automatically

This improved Type A Machine is even better than ever for obtaining many different finishes on a variety of materials. . . . Sand, polish, buff or satin finish on metal, wood, plastics, etc. Will handle diameters from ¼ to 6 inch at high rate of production.



Send us samples of your work for full laboratory report without obligation . . . It will pay you to investigate.

Production
MACHINE COMPANY GREENFIELD, MASSACHUSETTS, U.S.A.

FREE
TEST PAPERS
for
TESTING
ZINC
SOLUTION

Sulphur Products Co. Inc.
Greensburg 7, Pa.

SOLE PRODUCERS OF
McKeon's
Zinc-Brite
TRADE MARK REG'D.

ston. Huddleston Engineering Co., Bartlesville, Okla., and *Bruce L. Corey.* Socony-Vacuum Oil Co., Inc., Topeka, Kansas.

TECHNICAL LITERATURE

The Zinc Industry

Published by the American Zinc Institute, 60 E. 42 St., N. Y. 17, N. Y.

This is an interesting, non-technical story of the mine-to-market procedures of this important and useful metal. Enough of the technical facts and figures are included to enable one to get a clear and understandable picture of the zinc industry. This booklet is a complete revision of one published in 1940, with all production figures brought up to date, and is profusely illustrated. It should prove valuable to schools, students, and the general public where fairly complete information is wanted on zinc metal, its products and its uses. Copies are available free of charge from the American Zinc Institute.

Letters to the Editor

Metal Finishing
11 West 42nd Street,
New York 18, N. Y.
Dear Editor:

I was pleased to read Messrs. MacMullen's and Ozar's article on the use of "Sodium Silicates in Metal Cleaning" (April 1949). Their review of the work investigating silicate films should take care of the issue once and for all. Silicate cleaners are being successfully used to clean all types of metals including zinc and brass. Any detrimental effects from so-called silicate films formed in a good alkaline cleaner have yet to be proved; whereas the advantages of the silicate anion from the standpoint of detergency cannot be disputed.

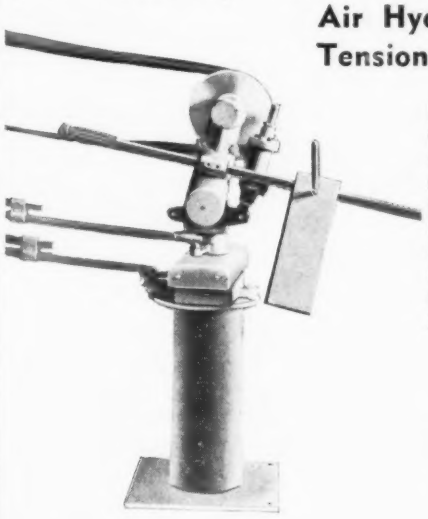
In commenting on the above article Dr. Walter Meyer has thrown the subject of cleaners for zinc based die castings wide open (letter to the Editor, May '49); we would like to add our comments.

Admittedly it requires detailed study to develop a superior alkaline cleaner for zinc. However, with proper balancing of components it is possible to obtain cleaners that will operate under more severe conditions than outlined by MacMullen and Ozar or Hazel and Stericker. An anhydrous cleaner that can be used at 4 to 8 oz./gal., 180°F., 20 to 50 amps. per sq. ft. can thus be formulated for anodic cleaning from five seconds to two minutes or more. Such a product might contain 50% Na_2O, and a 4 oz./gal. solution have a pH of about 13. We have evaluated cleaners of this type containing up to 37% sodium orthosilicate by the method outlined by Walter Meyer and find them to be very satisfactory. Production use has fully confirmed their value.

There is a tendency to speak of $Na_2O : SiO_2$ ratios when discussing anode attack as evidenced by a white deposit on zinc alloys. The emphasis should be, rather, on alkalinity; too low an alkalinity tends to promote whitening of the zinc while a high alkalinity causes blackening. The extent of these two forms of attack is influenced, within limits, by the presence of various anions including silicates. It is this factor that makes it possible

The NIEDERST COMPANY

Manufacturers of Back Stand Idlers designed for faster-smoother polishing plus versatility. Now available with Air Hydraulic Belt Tension Control.



Backed by eighteen years experience in the abrasive polishing field, the NIEDERST BACK STAND IDLER offers the utmost in both dependability and productiveness.

Write for Specification Sheet and information for introducing belt polishing on your present lathe equipment.

NIEDERST COMPANY
525 W. 76 St., Chicago 20, Ill.

Here's
POSITIVE FILTRATION
for your Plating Solutions

YOU can put an end to costly rejects and reworking caused by impurities usually present in plating solutions. You can remove this dirt, dust and oil-sludge and keep your solutions bright and clean with an Alsop "Sealed-Disc" Filter that actually eliminates all minute particles. We'll be glad to give you all the facts—just write Alsop Engineering Corporation, 408 Bright Street, Milldale, Conn.

ALSOP ENGINEERING CORPORATION
Filters, Filter Discs, Pumps, Tanks, Mixers, Agitators

to compound a cleaner that will not attack the zinc within broad use limits and yet have good detergent power and good life.

Very truly yours,
Pennsylvania Salt Mfg. Co.
ALFRED H. POPE
Product Development Division
R. & D. Department

Metal Finishing
New York City, N. Y.
Dear Editor:

In the discussion and also in the papers on the use of silicate cleaners for preparing zinc-base die-castings for electroplating, it appears that two important points have been overlooked.

Dr. Meyer advises the anodic cleaning of zinc-base die-castings and Mr. Stericker states that "we have no basis for judging why he (Dr. Meyer) prefers anodic to cathodic cleaning."

The solubility of zinc chemically in a caustic solution is well known. The contamination by zinc cannot be prevented, as the buffing composition remaining on the die-casting contains considerable zinc dust which goes into solution when the soil is removed. Recessed parts of die-castings may be both chemically and electrochemically attacked. The racks for holding the die-castings are coated with zinc that also may go into solution. In those ways the zinc content of the alkali cleaning solution becomes so high that when die-castings are cathodically cleaned a coating of non-adherent zinc is deposited. This coating of zinc may be imperceptible, but it is there and will become more evident as the zinc content of the alkali cleaner increases.

There is every probability that this coating is the cause of the blistering of any subsequent metal deposit when the die-casting is subjected to a heat treatment test.

In experimental work in a laboratory the above is not encountered, but it certainly is in a production plant, which is the place to study any cleaning process.

While silica content of a newly made cleaning solution may be "within the ranges of 1-5%," it is very probable that when the cleaner has been in use 5 days the silica content will be different and will be dependent upon the alkali present. The always found residue in an "old" cleaning solution indicates that the saturation point has been exceeded.

As a matter of interest, a simple test is to add a small amount of hydrochloric acid to a 500 ml beaker about half filled with a new solution and then compare with an "old" cleaning solution the resulting precipitate. The precipitate is a silica gel and that is what occurs when any high silica cleaning solution—an "old" one—is not thoroughly removed by rinsing in clean water which is a most difficult thing to do when there are screw holes, deeply recessed parts and lap welds. Then "leaking out" or "spotting out" may result.

The study of an alkali cleaner should be made in a small plating shop where it is not the practise to make new cleaning solutions frequently. In the illustration given in a recent paper the cleaning is not done in one solution as is the general practise in many plants, but in about 4 solutions—the work passing successively from one cleaning solution to another. In this system the final cleaning is in a solu-

True For You
True INSULATOR
• The perfect insulation for steam and water coils.
• Protects plating tanks from grounds and shorts.
• Avoids leaking steam. Will not blow out.
• Gives absolute insulation under most adverse conditions.
• Outlasts conventional hose with couplings.
• Made of rayon braid steam hose —rubber covered inside and out —with hex shaped, male-threaded couplings.
TRUE BRITE CHEMICAL PRODUCTS CO.
Order A TRIAL PAIR Now!
$6.50 per pair for ¾ in. size
Other sizes proportionately priced
Discounts on quantities
True Brite
CHEMICAL PRODUCTS CO.
P. O. BOX 31 OAKVILLE, CONN.
PRACTICAL PRODUCTS BY PRACTICAL PEOPLE

Now... Immediate deliveries on
SOLID PC GLASS BLOCKS
Ideal, long-lasting supports for acid or electrolytic tanks
• Impervious to moisture, vapor and the fumes of most common acids, PC Solid Glass Blocks are the preferred insulating supports for acid or electrolytic tanks.
These solid glass units are non-corrosive; have an ultimate compressive strength of 80,000 lbs. per sq. in. under uniform loading. They have stippled edges and clear faces—one flat and one dished. Dimensions are 5" x 5" x 2⅝". For complete information, write Pittsburgh Corning Corporation, Dept. J-80 307 Fourth Ave., Pittsburgh 22, Pa.
PITTSBURGH PC CORNING
GLASS BLOCKS
Distributed by PITTSBURGH PLATE GLASS COMPANY
by W. P. Fuller & Co. on the Pacific Coast and by Hobbs Glass Ltd. in Canada

tion scarcely contaminated with soil. There has been little change in the percentage composition of the ingredients and consequently the cleaning of the work is most thorough. The system employed rather than the effectiveness of the cleaning compound should have been reported. That system is ideal but seldom found in a production plant.

While literature is a good place to learn what someone has done, the better place is in production plants, not one but several.

Yours truly,
GEORGE B. HOGABOOM

Manufacturers' Literature

Cleaning Compounds

Magnuson Products Corp., Dept. MF, 50 Court St., Brooklyn, N. Y.

A folder just issued by this firm describes their line of cleaning compounds for the metalworking and metal finishing industries, and gives helpful information for performing cleaning operations economically. Still tank cleaning, electrocleaning, cleaning steels, copper-base alloys, white metals, and aluminum, and tumbling and burnishing are covered. Copies of this bulletin are available by writing to the above address.

Plating Widgets

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

A special issue of the H-VW-M News, issued by this company, is devoted entirely to plating widgets, the many little items used in and around metal finishing departments which play such an important part in the daily operations, yet which are often overlooked. Items such as crocks, acid pumps, hand brushes, wheel trimmers, insulating steam joints, rod connectors, emery troughs, anode bags, glue brushes and many others are described and priced.

Copies are available from the above address.

Air Operated Control Valves

Minneapolis - Honeywell Regulator Co., Brown Instruments Div., Dept. MF, Wayne and Roberts Aves., Philadelphia 44, Pa.

Series 700 Diaphragm Control Valves is the subject of a new catalog published by the above firm.

Bulletin No. 700-1 offers descriptions and drawings of the Diaphragm Motor Controlled Valve with Radiation Fins and Positioner; the Direct Acting and Reverse Acting Diaphragm Motor Controlled Valve with Manual Operator; the Supersensitive Pilot-Operated Valve; the Venturi Throat Valve; Three-Way, Duplex and Single-Seated Valves, etc.

Also included in this illustrated, 31-page catalog are dimension tables and ratings, shipping weights and cubical measurements. A section is devoted to the Pilot Piston Control Valves with flow charts, sizes and dimensions.

Bulletin No. 700-1 will be sent upon request.

Are You Satisfied With Your Finish?

Try

HARRISON'S

4A

COMPOUNDS

for

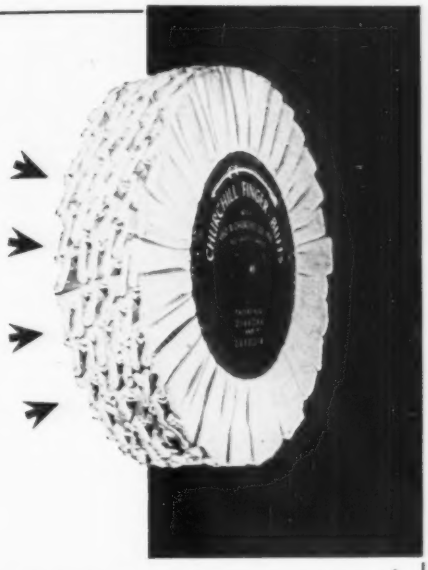
Aluminum, Brass, Copper, Stainless Steel, Carbon Steel, etc.

TRY OUR NEW GREASE STICK; ALSO OUR NEW WATER SOLUBLE COMPOUNDS.

Our technical Representative will be pleased to help you with your problems.

HARRISON & COMPANY, INC.
HAVERHILL, MASSACHUSETTS

FASTER CUTTING
LONGER WEAR
AIR-COOLED
WILL NOT BURN



185,000 PIECES PER WHEEL HAVE BEEN BUFFED WITH
CHURCHILL FINGER-BUFFS*
DESCRIPTIVE LITERATURE AND SAMPLES ON REQUEST

SOLE MFRS.
GEO. R. CHURCHILL CO., INC.
NO. QUINCY 71, MASS.
* TRADE MARK—PATENTS NOS. 2146284, 2350216. OTHERS PENDING.

Corrugated Lead Anodes for Chrome Plating

Belke Manufacturing Co., Dept. MF, 947 N. Cicero Ave., Chicago 51, Ill.

A new bulletin gives complete information on how Belke Corrugated Lead Anodes increase chrome plating efficiency; shows the larger anode surface area made possible by the corrugated design; describes the V-shaped, knife edge Belke Anode Hooks that assure positive two-point contact with bus bar.

Copy of Bulletin 804 furnished promptly on request.

New Selenium Rectifier Brochure

The International Rectifier Corp., Dept. MF, 6809 South Victoria Ave., Los Angeles 43, Calif.

This firm has announced a new 6-page brochure (identified as C-349-848) on its line of selenium rectifiers which is available without charge upon request. This booklet contains operating characteristics, applications, circuit diagrams and design data and also gives price information on the company's standard line of full wave, single phase, bridge rectifiers in stock. Also featured is a cross sectional view of a typical selenium rectifier stack and a description of the company's 6¼" x 7¼" selenium rectifier cell.

The brochure also describes the company's standard line of rectifier cells varying from 1¼" x 1¼" to 6¼" x 7¼" and their operating range from 2 volts and 150 ma. to 5,000 volts and 10,000 amperes.

Dipping Baskets

The Udylite Corp., Dept. MF, 1651 East Grand Blvd., Detroit 11, Mich.

A new folder just issued by the above firm illustrates the various types of baskets manufactured by them for

INDIAN BRAND

TURKISH EMERY

This old time famous brand of emery is now in stock. Many have been waiting for it. Also available are POLISHING ABRASIVE —best for finest finishing and AMERICAN EMERY—most economical.

HAMILTON
EMERY & CORUNDUM COMPANY
Chester Mass.

GRANIUM
A Precious metal complex salt for Silver & Gold Plating
Used as an additive
Harder Plate
Tarnish Resistant
Cyanide & Anodes
Write for booklet.

GRANIUM PRODUCTS
4427 Ledge Avenue
North Hollywood, Calif.
Chemical Engineers since 1905

SOMMERS BROS. MFG. CO.
MFRS. OF "BEACON"
Plating and Polishing Supplies and Equipment —Complete Semi and Full Automatic Installations—Gold, Silver and Chrome Rouge, Stainless Steel and Satin Finish Compounds — Buffs, Polishing and Felt Wheels.
WRITE FOR PRICES
3439 NO. BROADWAY
ST. LOUIS 7, MO.

DIXRIP
FINE WIRE SCRATCH BRUSHES

Goblet Brush

Goblet brush shown can also be supplied with 3½" long handles. Tapered arbor hole for direct mounting on tapered spindle. Made in diameters ⅞" to 6" of bristle or brass, steel or nickel silver wire.

Ask for Dixrip Brushes at your supply house or write us for catalogue and price list.

DIXON & RIPPEL, INC. KINGSTON, N. Y.
Established 1856

"JUST WHAT THE DOCTOR ORDERED"
That's what PLATERS say about* "ELECTROPLATING KNOW HOW"
A new correspondence course in practical electroplating; written and personally conducted by Joseph B. Kushner, Metal Finishing Engineer.
Write today for free particulars
JOSEPH B. KUSHNER Ch. E.
Stroudsburg 55, Pa.
* John Fedor, Plating foreman, Willowick, Ohio

4 BIG REASONS WHY YOU SHOULD USE STRIPODE
TO STRIP NICKEL
★ Cuts acid consumption ★ Reduces pitting and roughening
★ Protects base metal ★ Minimizes need for buffing and coloring
WRITE RIGHT NOW FOR MORE INFORMATION
THE CHEMICAL CORPORATION
54 Waltham Avenue
SPRINGFIELD • MASSACHUSETTS

DOMESTIC **"VIENNA"** LIME
ROCKWELL BRAND
ABRASIVE FOR USE IN
COMPOSITIONS AND STEEL POLISHING
Inquiries—Domestic and Foreign—Solicited
ROCKWELL LIME COMPANY
QUARRIES: MANITOWOC WISCONSIN
OFFICES: 228 NO. LA SALLE ST. CHICAGO 1, ILL.

handling small parts in bulk for dipping, cleaning, and plating operations. A complete range of sizes, meshes, handle styles, and materials is available. Copies of the folder are available without charge from the above address.

How Blast Cleaning Replaces Acid Pickling for Metal Cleaning

American Wheelabrator & Equipment Corp., Dept. MF, 555 S. Byrkit St., Mishawaka, Indiana.

An illustrated, informative bulletin describes how Wheelabrator airless blast cleaning equipment offers many advantages that makes it one of the fastest, safest and most effective metal cleaning processes on the market today.

Included in this descriptive booklet are numerous case history studies which relate the advantages obtained by prominent concerns in replacing their acid pickling process with Wheelabrator equipment. Among those shown are forge plants, enameling shops, job plating concerns and a manufacturer of steel pipe and tubing.

A detailed summary of the two metal cleaning processes presents the inherent serious problems of using acid pickling for metal cleaning—safety hazards, acid disposal, etc.—and compares the benefits obtained by airless blast cleaning.

A copy of the 16 page, Bulletin No. 584 will be sent upon request.

Chemical Resistant Cement

The Ceilcote Co., Dept. MF, Rockefeller Bldg., Cleveland, O.

This firm has just issued a bulletin describing their new synthetic cement, which is claimed to resist acids, alkalies, and solvents and be resistant to temperatures up to 375°F. It is also said to have high bond strength, low absorption, and high density. The material is shipped as a liquid and a dry powder that require mixing just prior to use. When separate, these materials are claimed to be very stable for long periods of time. The bulletin lists uses and specific resistance to a wide variety of chemical solutions. Copies of the bulletin are available from the above address.

High Output
Selenium Rectifiers
• International R.C. selenium rectifiers are engineered to meet individual requirements. Wide range of voltages and current ratings available. Samples supplied promptly.
International Rectifier Corporation
68th & Victoria Ave., Los Angeles 43

Hartford
GUARANTEED
STEEL BALLS
Best for Burnishing . . . Perfect for Polishing. No culls, no cracks.
Mixtures as Required
THE HARTFORD STEEL BALL CO.
HARTFORD 6, CONN.

Unsurpassed for Dependable Accuracy
Filpaco
FILTER PAPERS
FILTER CLOTHS, CLOTH BAGS, ASBESTOS PADS and other filter media
For all types of plating solution filters . . . cut to any size and pattern . . . light and heavy weights . . . large stock maintained . . . samples furnished upon request, for experimental purposes.
Write for quotations today.
Other "FILPACO" Products:
Filters, stainless steel storage and mixing tanks, fillers, pumps, conveyors, fittings, filter paper, filter cloth, asbestos pads and filter aids.
FILPACO
THE FILTER PAPER CO.
2417 S. MICHIGAN AVENUE CHICAGO 16, ILLINOIS

HOLLAND SAYS:
NOW IS THE TIME TO REPLACE THAT OLD GENERATOR
• Motor Generator Sets in all sizes •
J. HOLLAND & SONS, INC.
MANUFACTURERS • DEALERS
276 SOUTH NINTH ST. • BROOKLYN, N. Y.

Buffing and Polishing Lathes

Lima Electric Motor Co., Dept. MF, Lima, Ohio.

The above firm has just announced the release of their new Bulletin DB-1. This bulletin describes in detail Lima Gearshift Drives for selective speed machine operation; Lima Electric Motors and Lima Pedestal Grinders; Buffing and Polishing Lathes. It contains specific information on Lima Pedestal Grinders; Buffing and Polishing Lathes. This bulletin is free upon request.

Packing Materials for Corrosive Liquids

Fischer & Porter Company, Dept. MF, 97 County Line Rd., Hatboro, Pa.

Materials of Construction and Packing Materials for use with over 300 industrial liquids and gases are listed in a new and revised Catalog Section 97, published by the above firm. This tabulation of corrosion-resistant materials is based on previously published data, complemented by the company's world-wide experience in handling corrosive fluids. It is believed to be the most complete and up-to-date bulletin available for ready reference. Copies may be obtained by writing to the above address.

New Method of Tank Heating Explained

Kold-Hold Mfg. Co., Dept. MF, Lansing 4, Mich.

A unique new method of tank heating apparently has many advantages over pipe coils as heat transfer units. Such things as dumping the tanks to make repairs and extensive maintenance procedures are unnecessary with this new method, it is claimed. A lightweight, embossed plate called a "Platecoil" is used to carry the heating solution. It has a high BTU capacity per square foot area and therefore takes up little space in the tank, according to a bulletin just released by the manufacturer. "Platecoil" can also be used for cooling high temperature solutions. This bulletin shows how much easier the Platecoil is to install and maintain. It contains a complete description and all specifications. A copy will be mailed free on request.

Belke Utility Plating Racks

Belke Mfg. Co., Dept. MF, 947 North Cicero Ave., Chicago 51, Ill.

Gives complete information on the five models of Utility Racks that efficiently handle 90% of all plating jobs, including bright nickel and chrome. Shows the revolutionary improvements in rack flexibility made possible by the new Vac-Seal Removable Tip Assemblies used on Utility Racks.

Copy of Bulletin 980 furnished promptly on request.

BUYERS

of any QUANTITY of the following SCRAP

Ni—Anodes
Ni—Peelings . . . Strippings . . . Nodules . . . Trees
Cr—Strippings . . . Nodules . . . Trees
Ni—Deposited on iron-hooks . . . Racks . . . Hangers
Tin—Plating Residues
Cadmium—Trees . . . Strippings . . . Nodules . . . Trees . . . Residues
Molybdenum—Tungsten
Gold—Silver
Platinum—Scrap . . . Residues . . . Strippings

★

Write indicating grade and quantity available

METALLURGICAL PRODUCTS CO.
Established 1909
35th & Moore Sts., Phila. 45, Pa.

OXY-DYZ-ENE
HIGHEST STRENGTH
OXIDIZING AGENTS
POSSIBLE TO PRODUCE
Sold in LUMP and LIQUID FORMS by Leading Plater Supply Houses
Manufactured For 68 Years By
KREMBS & COMPANY
669 W. OHIO ST. CHICAGO, U.S.A.

Zialite
Reg. U. S. Pat. Office
FOR NICKEL PLATING
The one bath especially designed for plating diecastings made of WHITE METAL ALLOYS including ZINC, LEAD, and ALUMINUM. ZIALITE also plates on COPPER, BRASS, and IRON.
USE
Zialite ADDITION AGENTS
for
HARD CHROMIUM BATHS
Finer-grained deposits.
Increased throwing power.
Less sensitivity to sulfate content.
ZIALITE CORPORATION
92 Grove Street, Worcester 5, Mass.

THE ARTISAN COMPANY
MANUFACTURERS OF PLATING RACKS
INSULATION APPLICATORS
(OVEN BAKED)
FACTORY—WAREHOUSE—OFFICE
NOW LOCATED AT
97 CROSBY STREET
NEW YORK, N. Y.
CAnal 6-7008
(Catalog on Request)

WHEN IN NEW YORK

VISIT OUR FREE
PERMANENT FINISHES EXHIBIT
OPEN DAILY 10 A.M. TO 5 P.M. MONDAY THROUGH FRIDAY
SAMPLE COPIES OF OUR PUBLICATIONS and MANUFACTURERS' CATALOGS AVAILABLE FREE
at the offices of
FINISHING PUBLICATIONS, INC.
11 WEST 42nd STREET • NEW YORK 18, N. Y.